

A photograph of the Manhattan Bridge at night, illuminated with blue lights. The bridge's suspension cables and towers are visible, and the city lights of Manhattan are reflected in the water below. The sky is a deep blue.

YOUR GUIDE TO THE
ASHRAE
WINTER
CONFERENCE

JANUARY 18–22, 2014
NEW YORK

Included Inside:

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

Your Guide to the ASHRAE Winter Conference

January 18–22, 2014

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ASHRAE EVENTS APP

Search for 2014 Winter Conference sessions by name, location, speaker or description; have maps and floorplans in your hand to find your way around; add sessions to your personal schedule; receive announcements directly from ASHRAE and more, all on your smartphone or tablet. Available in the iTunes App Store and Google Play Store. The app is made possible through support from Platinum Sponsor Taco and Gold Sponsors Climaveneta, Munters, System Air.



Download the Conference App at www.ashrae.org/app

PERSONAL PROGRAM—PLAN YOUR OWN MEETING SCHEDULE!

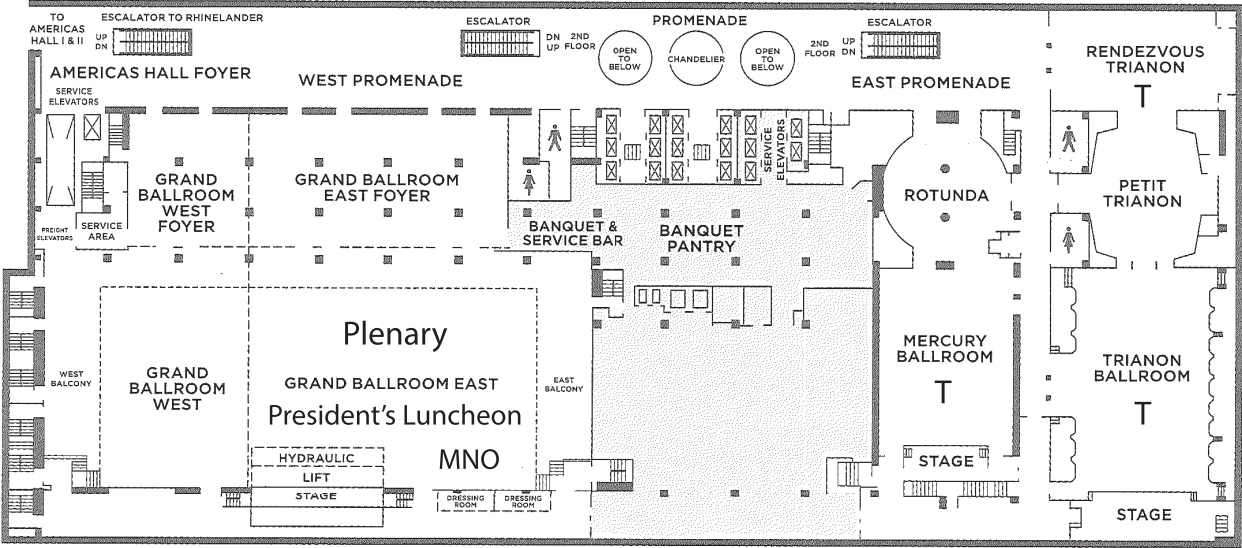
FRIDAY, JANUARY 17	SATURDAY, JANUARY 18	SUNDAY, JANUARY 19
8:00 am–12:00 noon	8:00 am–12:00 noon	8:00 am–9:30 am
1:00 pm–5:00 pm	8:00 am–3:00 pm	8:30 am–12:00 noon
5:00 pm–10:00 pm	1:00 pm–3:00 pm	9:45 am–10:45 am
	3:15 pm–5:00 pm	11:00 am–12:30 pm
		1:30 pm–3:00 pm
	6:30 pm–8:30 pm Welcome Party Rock Center Café Rockefeller Center	3:00 pm–7:00 pm

NOTES:

PLAN YOUR OWN MEETING SCHEDULE!—PERSONAL PROGRAM

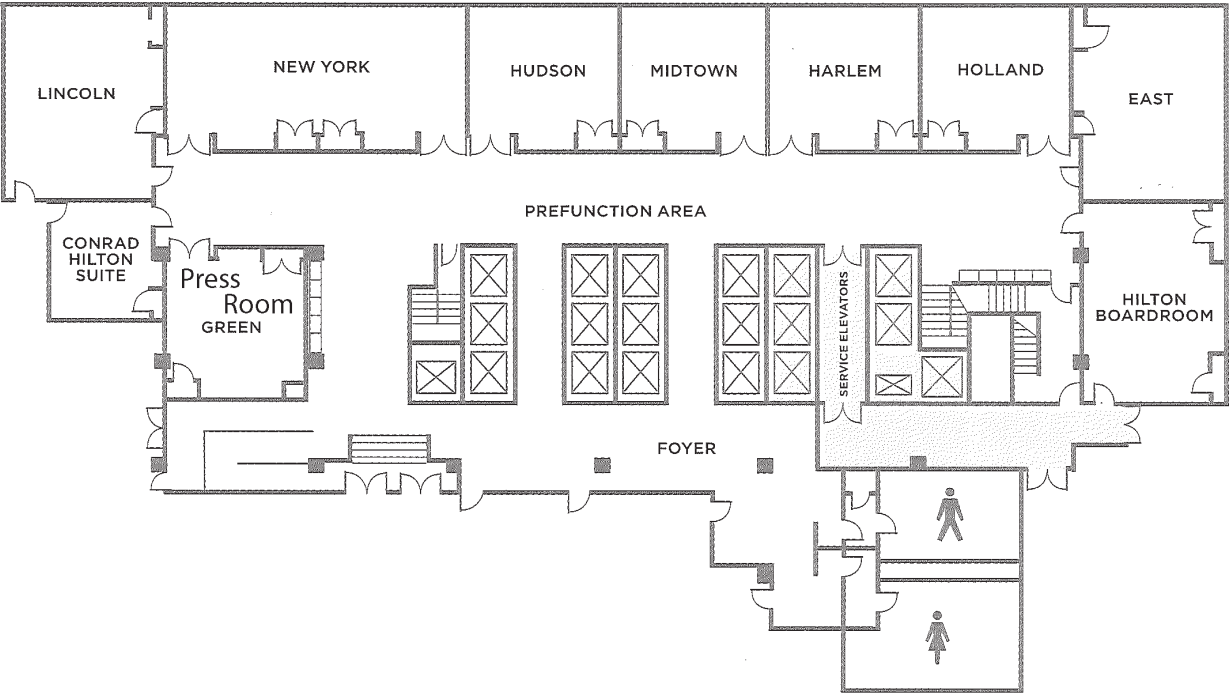
MONDAY, JANUARY 20	TUESDAY, JANUARY 21	WEDNESDAY, JANUARY 22
8:00 am–9:30 am	8:00 am–9:00 am	8:00 am–9:30 am
9:45 am–10:45 am	9:45 am–10:45 am	9:45 am–10:45 am
11:00 am–12:00 noon	11:00 pm–12:30 pm	11:00 am–12:30 pm
12:15 pm–2:00 pm President’s Lunch New York Hilton Grand Ballroom	1:00 pm–3:30 pm	1:00 pm–5:00 pm
2:15 pm–4:15 pm	3:30 pm–6:00 pm	
4:15 pm–6:30 pm	6:15 pm–10:30 pm Members’ Night Out New York Hilton Grand Ballroom	

NEW YORK HILTON THIRD FLOOR

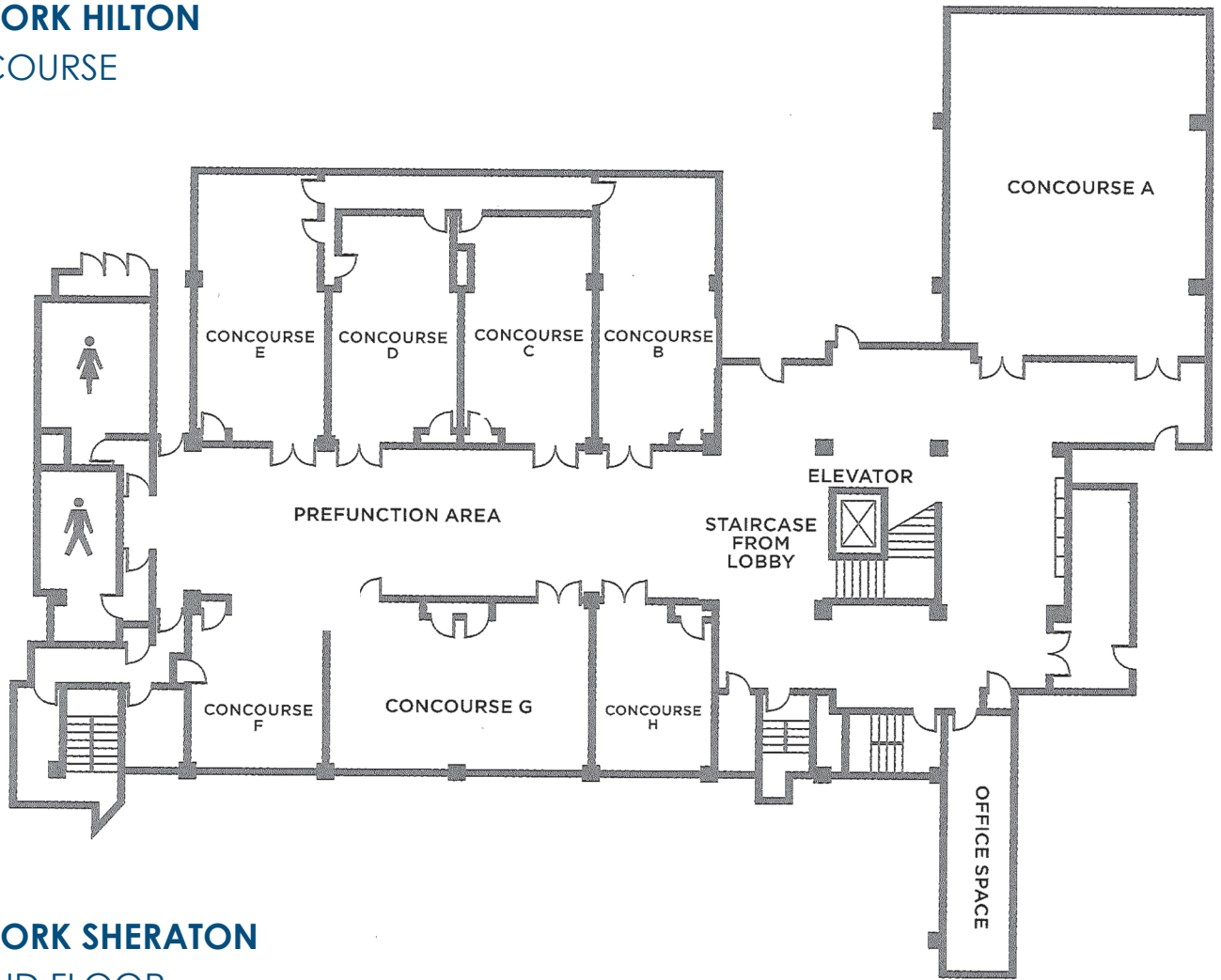


T = Technical Session

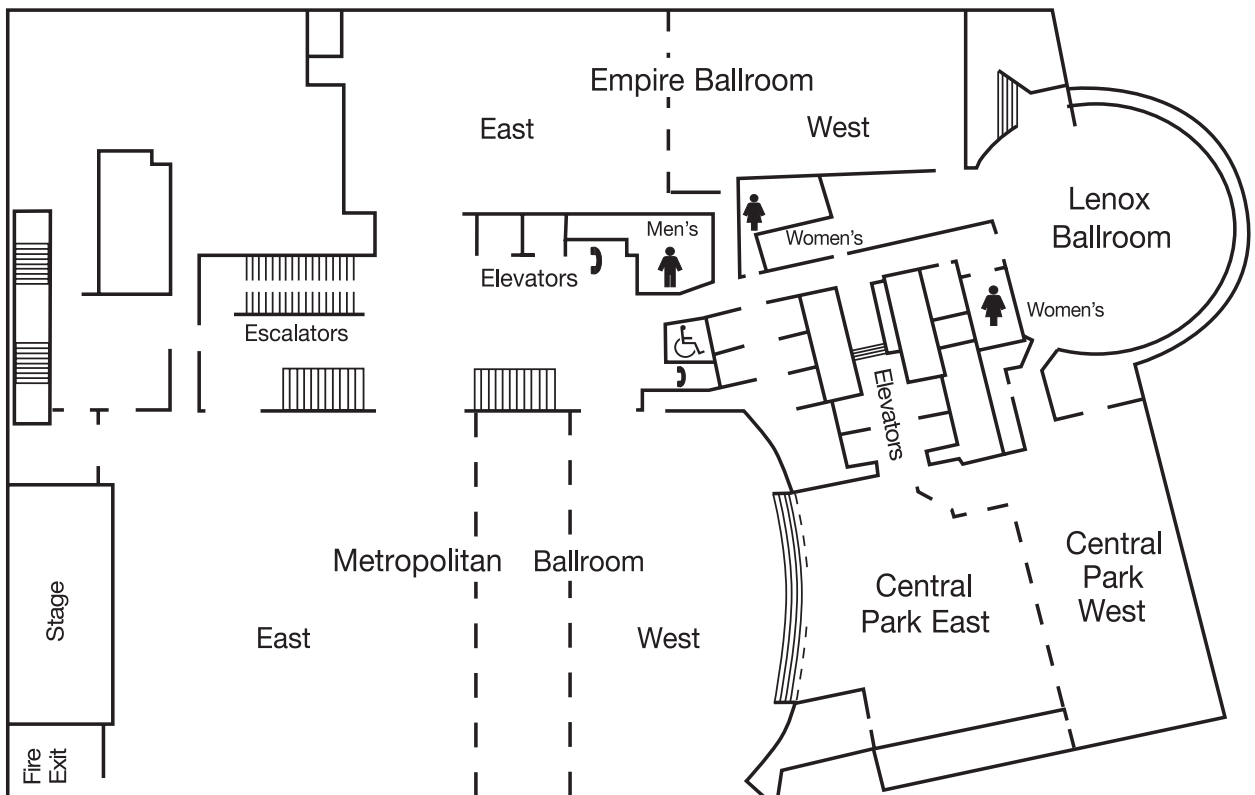
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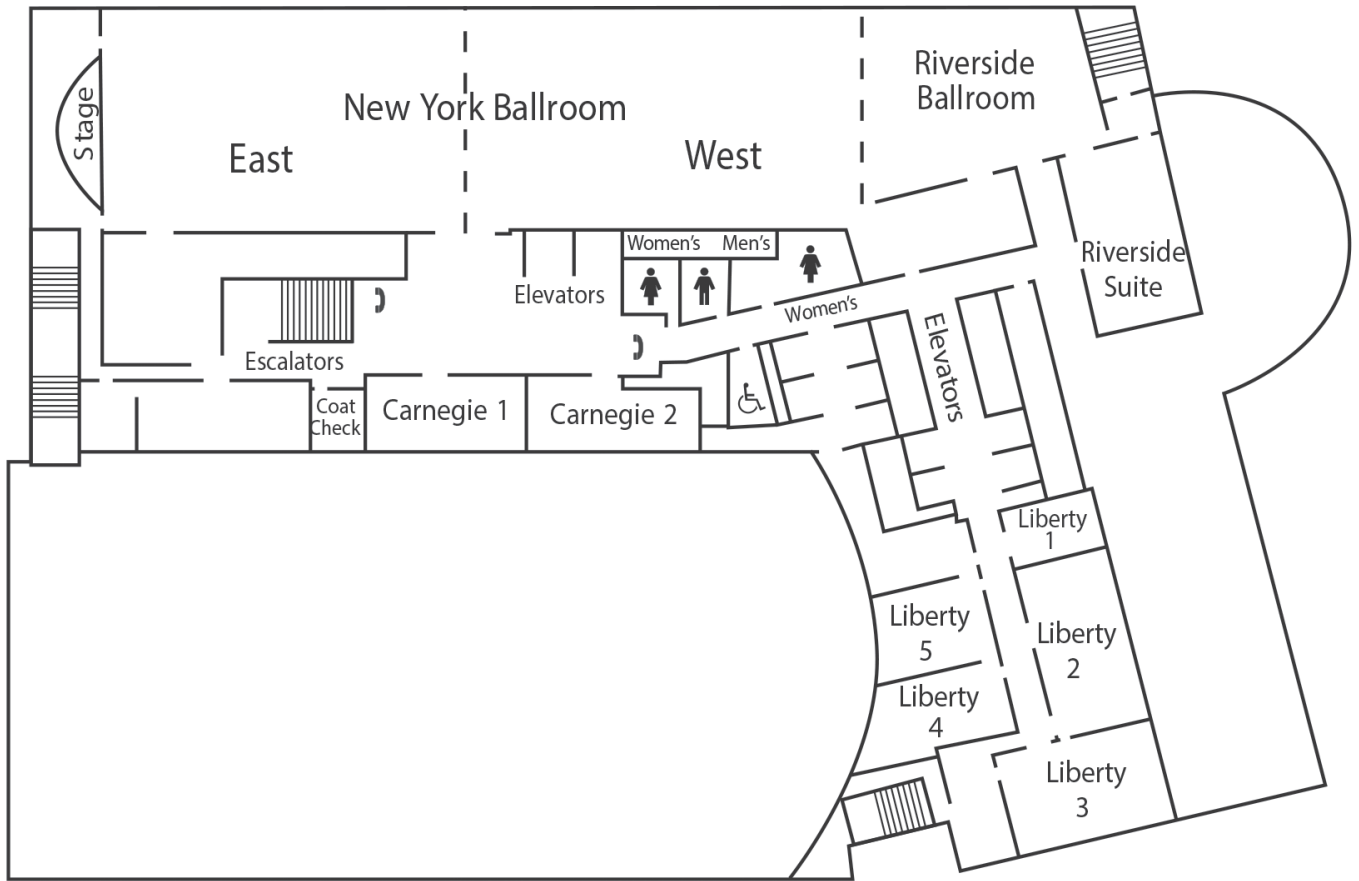
NEW YORK HILTON
CONCOURSE



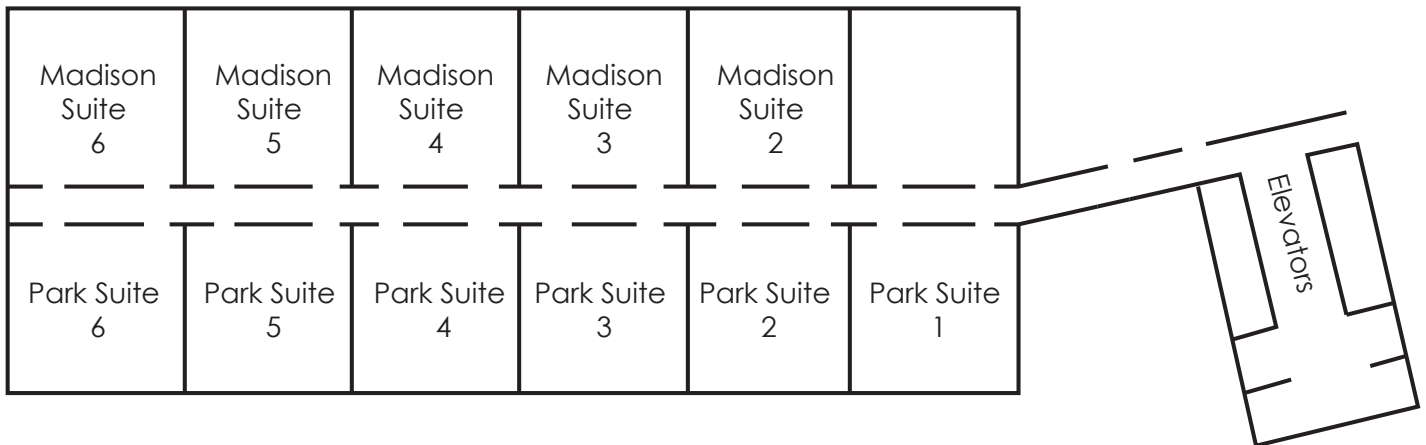
NEW YORK SHERATON
SECOND FLOOR



NEW YORK SHERATON
THIRD FLOOR

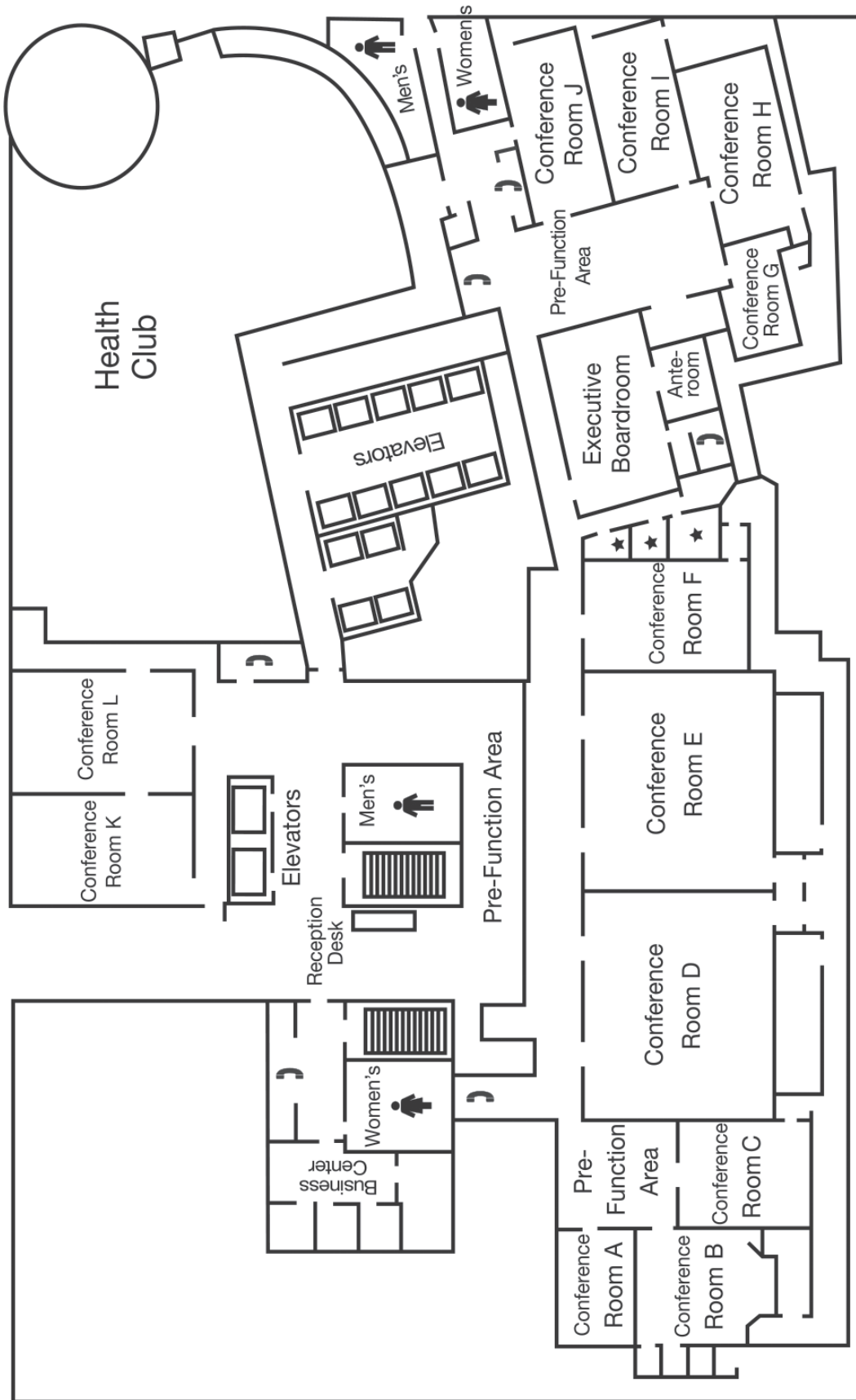


NEW YORK SHERATON
FIFTH FLOOR



NEW YORK SHERATON

LOWER LEVEL



ASHRAE FUTURE CONFERENCE SCHEDULE

ASHRAE's conference schedule for 2014 stretches globally while also specializing with some specific regional focus. The topics range from high performance buildings to buildings that have combustion with low-grade fuels. ASHRAE conferences present the latest developments in the industry and fundamental, tried and true practices. Mark your calendars now so you don't miss out on these ASHRAE conferences that help to shape tomorrow's built environment today!

These conferences feature peer-reviewed papers, presentations with hands-on information presented in a non-commercial format, Professional Development Hours and networking opportunities.

Feb. 24–26, 2014 – First International Conference on Energy and Indoor Environment for Hot Climates, Doha, Qatar | www.ashrae.org/hotclimates

This conference is the first to tackle energy and indoor environmental quality issues in humid and arid hot climates, providing a forum for discussion of the latest research and developments. Consulting engineers, building owners, industry manufacturers, environmental organizations, researchers, scientists and all interested professionals are invited to present and participate.

Co-Sponsor: AHRI – www.ahrinet.org

Organized by: ASHRAE Qatar Chapter – www.ashraeqatar.com
Qatar Environment and Energy – www.qeeri.org.qa

Platinum Sponsor: Qatar Cool

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Endorsed by: CIBSE – www.cibse.org
UNEP – www.unep.org
IAPMO – www.iapmo.org
REHVA – www.rehva.eu

Feb. 26–28, 2014 – 49th AiCARR International Conference, Historical and Existing Buildings: Designing and Retrofit, Rome, Italy | www.aicarr.org

The conference is devoted to providing a deep overview on the retrofit design of the historical and existing buildings. The theme is related to the energy performance, indoor air quality energy sustainability and to innovations in buildings and systems. The conference aims to address the systems and equipment applicable today in existing buildings and to improve energy performance, indoor environmental quality and sustainability.

Endorsed by: ASHRAE – www.ashrae.org

April 7–8, 2014 – High Performance Buildings Conference, San Francisco, California

Building upon its 2012 High Performance Buildings Conference and 2009 Net Zero Conference, ASHRAE seeks to advance the industry's efforts to change the energy-use aspects of the built environment through its 2014 Conference. The tracks include

building performance modeling, envelope strategies, lighting/daylighting strategies, indoor environmental quality strategies, building occupant behavior, market value, new building technologies and case studies and lessons learned. The conference is presented by ASHRAE's High Performing Buildings magazine.

Endorsed by: www.hpbmagazine.org/HPB2014

Bronze Sponsor: p2s

April 24–26, 2014 – Efficient, High Performance Buildings for Developing Economies, Manila, Philippines | www.ashrae.org/Developing2014

The design, construction and operation of energy efficient, high performance buildings in developing economies have been identified by the building industry and policymakers as a key area where technology, standards and investments are needed. The conference will address a number of themes on this topic.

Organized by: ASHRAE, ASHRAE Phillipines Chapter

Sustainability Partner Sponsorship: Trane

Co-sponsor: AHRI – www.ahrinet.org

Endorsing organization: IAPMO – www.iapmo.org

June 28–July 2, 2014 – ASHRAE Annual Conference, Seattle, Washington | www.ashrae.org/seattle

ASHRAE visits Seattle, known as a city that eats, breathes and acts green. The Conference addresses broad topics in the application of technology to practice, specific applications in ground source heat pumps, operations and maintenance and indoor environmental quality as well as new reports on research taking place worldwide.

Sept. 10–12, 2014 – ASHRAE/IBPSA-USA Building Simulation Conference, Atlanta, Georgia www.ashrae.org/simulation2014

The conference merges the IBPSA-USA SimBuild and ASHRAE Energy Modeling Conferences. The focus is on making better decisions through the application of simulation and modeling over the entire building life cycle from the earliest concept through operation and maintenance. Modelers, software developers, owners and researchers will address the practices of energy modeling and building performance simulation using existing simulation tools, software development, and future simulation research and applications.

Oct. 2–3, 2014 – International Conference on Efficient Building Design: Materials and HVAC Equipment Technologies, Beirut, Lebanon | www.ashrae.org/Beirut2014

The Conference presents the latest research and development to improve building designs and state-of-the-art technologies in building materials and systems. Reducing energy consumption and carbon dioxide emissions, implementing energy efficiency standards and introducing new equipment and technologies are areas seeking improvement in the Arab region.

Organized by: ASHRAE – www.ashrae.org
ASHRAE Lebanese Chapter
<http://lebanese.ashraechapters.org>
American University of Beirut – www.aub.edu.lb
The Munib and Angela Masri Institute of Natural Resources

PREVIEW: SEATTLE

2014 ANNUAL CONFERENCE JUNE 28 – JULY 2, 2014

www.ashrae.org/Seattle

The Seattle Annual Conference will be held at the Sheraton Seattle, 1400 Sixth Avenue. Rates are \$185 single or double.

Pike Place

Pike Place's nine acres have been a staple in Seattle for more than a century. It's been called "the soul of Seattle," and for good reason. When it opened on Aug. 17, 1907, eight farmers sold their wares to more than 10,000 people who came out on a crazy first day. It hasn't slowed since. The market is now home to more than 200 businesses, 190 crafts people and about 100 farmers. Now more than 10 million visitors come to it annually.

It's easy to love the market for its fabulous selection of gourmet ingredients and staples, but it's also a great place to enjoy many fantastic eateries serving prepared dishes. It's the kind of place that caters to any hunger pang. And yes, they do throw fish here. So you can see that, too.

Key Attractions:

The original Starbucks is located right on the cobblestone Pike Place. Sure, there are endless Starbucks in the city, but this is the first and just feels different. Java addicts crowd it daily.

If you want quintessential Pike Place, check out the guys at Pike Place Fish. Throughout the day, they lob massive fish over the counter to the joy of spectators. Pike Place Fish will wrap purchases in airplane-safe containers.

Just to the northeast of the main arcade are rows of artisan vendors selling everything imaginable, from knickknacks to gorgeous works of local art. Downstairs are dozens of small shops selling every type of antique and souvenir imaginable.

Weather

It's been said that Seattleites will exaggerate about how much it rains in order to deter visitors from moving to their enchanting city. In reality, Seattle gets less rain than New York, Miami and dozens of other U.S. cities. Learn the truth about Seattle's weather. Average daily temperature in June is 69.2F, 20.7C

New in Seattle

The 2nd Annual ASHRAE Research Track will present innovations in HVAC&R research with particular emphasis on Renewable Energy Research and its role as we strive towards a clean energy economy. Researchers will present papers, seminars, forums or participate in panel discussions. Also, highlights on ongoing ASHRAE funded research will be presented. Join us in this comprehensive compilation of research-related papers and programs that peer into what the future holds.

Welcome Party

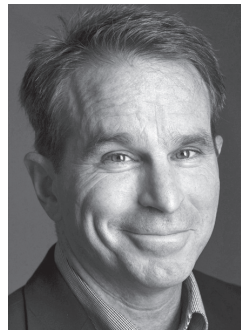
Saturday, June 28, 6:30 – 8:30 p.m.

Maritime Event Center at Bell Harbor International Conference Center

Maritime Event Center, adjacent to Bell Harbor, provides a historical maritime setting for the Welcome Party. Offering views of Puget Sound with its passing ferry boats and harbor activity and maybe a view of a harbor seal, it's a wonderful way to start the conference.

Keynote Speaker, Plenary Session

Saturday, June 28, 3:15 – 5:00



Robert Bryce is one of America's most prominent energy journalists. A passionate and engaging speaker, Bryce is a senior fellow at the Manhattan Institute. He is the author of four books as well as hundreds of articles. His writing on energy and other topics has appeared in dozens of publications ranging from the Wall Street Journal to Counterpunch and Atlantic Monthly to the Washington Post.

Bryce's first book, *Pipe Dreams: Greed, Ego, and the Death of Enron*, was named one of the best nonfiction books of 2002 by Publishers Weekly. In 2008, he published *Gusher of Lies: The Dangerous Delusions of "Energy Independence."* A review of *Gusher* in the New York Times called Bryce "something of a visionary and perhaps even a revolutionary." His fourth book, *Power Hungry: The Myths of "Green" Energy and the Real Fuels of the Future*, was published in 2010. The Wall Street Journal called *Power Hungry* "unsentimental, unsparing and impassioned; and, if you'll excuse the pun, it is precisely the kind of journalism we need to hold truth to power." The Washington Times called it a "magnificently unfashionable, superlatively researched new book dares to fly in the face of all current conventional wisdom and cant."

In 2014, he will publish his fifth book: *Smaller Faster Lighter Denser Cheaper: The Catalysts Driving Business and Innovation*, which explains how we humans are doing more with less and why we have every reason to be optimistic about the future.

Tours

Some great tours are being arranged. Here's a tentative schedule of what will be offered.

Technical Tours:

- Bullitt Foundation: Net zero office building
- University of Washington Microbiology Building and Central Plant
- Fred Hutchinson Cancer Research Center
- Bill and Melinda Gates Foundation
- Federal Center South

General Tours:

- Boeing Everett Facility
- Museum of Flight
- Seattle Lakes Tour
- Cascades, Cabernets, & Chocolates
- Museum of History and Industry
- Tillicum Village Cruise

CONFERENCE SPONSORS

ASHRAE thanks the following sponsors for their support of the 2014 New York Conference



Globally Recognized. Industry Respected.

Sponsor of the ASHRAE Bookstore



Sponsor of Conference Lanyards



Sponsor of Conference Notepads

CHAPTER AND SOCIETY OFFICIALS

A special thanks to all the members in the New York Chapter who helped make the 2014 Winter Conference a success!

NEW YORK CHAPTER OFFICERS

Ramez M. Afify, President
Lorey Flick, President-Elect
David R. Pospisil, Vice President
Clararose Voight, Secretary
Gene Geyer, Treasurer

NEW YORK HOST COMMITTEE

General Chair, Jin Jin Huang
Vice Chair, David R. Pospisil
Tours, Frank Rivera and Steven Baumgartner
Entertainment, Lorey Flick and Rob Schmitz
Sessions, Yolanda Wright and Mitchell Castell
Hospitality, Brian Ryglewicz
Information/Publicity, Steven Baumgartner

ASHRAE OFFICERS

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Thomas H. Phoenix, P.E., President-Elect
T. David Underwood, P.Eng., Treasurer
Darryl K. Boyce, P.Eng., Vice President
Bjarne W. Olesen, Ph.D., Vice President
Daniel C. Pettway, Vice President
Thomas E. Werkema, Vice President
Jeff H. Littleton, Executive Vice President

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Wade H. Conlan, Vice Chair
Pamela L. Androff
Chris A. Balbach
Walid Chakroun
David E. Claridge
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Charlie D. Curlin, Jr.
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Kevin B. Gallen
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Yunho Hwang
Thomas H. Kuehn
Jennifer Leach
James F. Liston, Jr.
Carol E. Marriott
Sarah E. Maston
Michael J. McDermott
Robert A. Neely
Joel C. Primeau
Leon Shapiro
Jeffrey K. Smith
Jeffrey D. Spitler
Samir R. Traboulsi
Andrea Zarour

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 scanning badges at the rooms. The scanning process will provide you with a summary of all sessions attended at the conclusion of the conference and will be sent directly to you by email. 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 Technical Paper Sessions. Questions are given to the authors for reply and published in *ASHRAE Transactions*.

HOTEL ADDRESS, TELEPHONE

Hilton New York
1335 Avenue of the Americas
Telephone: 212-586-7000

DIRECTIONS TO SHERATON FROM THE HILTON

There are TC/SPC committees scheduled at the Sheraton. Please exit the Hilton New York from the Lobby Level exit located near the front desk or through the exit to the parking garage to 53rd Street. The Sheraton's address is 711 7th Avenue on 53rd Street. The Sheraton is across the street from the Hilton on 53rd. Please note that there are some room names that are the same or similar to rooms in the Hilton. One example is Madison. If it is the Madison in the Hilton there will be no number associated with it and there will be an (H) for Hilton next to the room name. If it is Madison 1 to 6 it is the Sheraton with an (S). All of the meeting rooms except Madison and Park are in the conference center of the hotel and accessible via elevator. Madison and Park are accessible via the elevator in the main lobby of the hotel on the 5th floor.

ONLINE REGISTRATION

Need to register or buy a ticket for social events, tours, or Learning Institute courses? You can register online 24/7 throughout the conference. You can also register during registration hours in Rhinelander Gallery, 2nd floor of the Hilton. Just come to registration to pick up your tickets or badge.

INTERNET ACCESS

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

NEW IN NEW YORK

Wireless internet will be available in all meeting rooms. ASHRAE will be working with the internet provider to manage the bandwidth so that member expectations of accessibility and speed are fulfilled. Without any history of how much bandwidth will be used during certain times we would like to request that everyone limit their usage to functions that do not use excessive bandwidth such as Facebook, YouTube, streaming video, etc. Access code for the wifi is ashrae2014 and the code is case sensitive.

The ASHRAE app has several sections, including an "Event At A Glance" that provides information on the conference including committee meeting schedules and room assignments. The new conference app features the ability to message other attendees at

the conference. Only registered attendees will be able to download the Event and use the new networking tools. To remove your name from displaying in the "Attendees" listing on the app, select "My Meeting" and then "My Profile". From there, select the bottom menu item – Profile Option – and uncheck "Display in App".

NOTICE

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

CELL PHONES/PAGERS

Please be considerate and turn off your phones and pagers in committee meetings and technical paper and conference paper 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 the New York Hilton, ASHRAE's headquarters hotel.

SALE OF MERCHANDISE

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

SIGNS/DISPLAY OF AFFILIATE MEETING INFORMATION

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

PHOTO RELEASE

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

WHAT TO WEAR

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

LOST AND FOUND



Items found during the conference should be turned into the staff in the ASHRAE headquarters room, Nassau, or ASHRAE registration in the Rhinelander. If you have misplaced something during the conference please check these two locations as well as security with the hotel and convention center.

INVITATION TO ALL NEW MEMBERS, FIRST-TIME ATTENDEES AND NON MEMBERS

2:30-3:30, Hilton, Petit Trianon, 3rd floor
Sunday, January 19

If you've never attended an ASHRAE meeting before, join us and meet some of your fellow first timers. New Member, 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.

TECHNICAL PROGRAM PDHs

All of the sessions presented in the technical program are approved for professional development hours (PDHs), including State of Florida PDHs. In addition, some sessions are approved for the State of New York PDHs and AIA Learning Units. Those programs are indicated with a  symbol. Others are approved for LEED AP credits and are indicated with a  symbol. Certain sessions may be acceptable for ASHRAE certification renewal. Send questions to certification@ashrae.org. In order to report your attendance at the session, PDH and AIA sign-in sheets are in the session room. *Sessions are approved for 1, 1.5 or 2 PDHs depending on the length of the session.*

SCANNING

Your badge will be scanned as you enter the session and a summary of sessions attended will be emailed to you upon conclusion of the conference. The scanning process may take a little longer to get into the room so have patience. Please keep track of the sessions that you attend at the conference. If you do not desire to have a summary of the sessions you do not need to be scanned.

MEETING PAPERS

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

VIRTUAL CONFERENCE *Free for Paid Conference Registrants*

ASHRAE is offering 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 New York 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 will receive an email notification when sessions are posted online. If you do not have your password and link, go to www.ashrae.org/newyorkvirtual 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 all technical paper session presentations
- Ability to post questions or answers for selected sessions through Wednesday, Feb. 5. Presentations available online for 18 months.

A full slate of technical programs will be posted beginning Monday, Jan. 20, of the sessions that were presented the previous day, with additional content posted through Wednesday, Jan. 22. On-site registration is available for those who would like to purchase the Virtual Conference. To purchase you can do so online

or go to ASHRAE Registration, Hilton, Rhinelander Gallery, 2nd floor, \$249 ASHRAE member; \$445 non member. If you register on site, your password will be emailed to you within 24 hours of your registration.

AHR EXPO®

Jacob K. Javits Convention Center
655 W. 34th Street, New York, NY

Hours: (NOTE CHANGE IN THE NORMAL FORMAT – AHR EXPO opens on Tuesday)

Tuesday, January 21	10:00 a.m.–6:00 p.m.
Wednesday, January 22	10:00 a.m.– 6:00 p.m.
Thursday, January 23	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 Javits Convention Center. Registration for the AHR Expo® will be open from Noon to 4:00 p.m. on Monday, January 20. Starting Tuesday, you can register one hour before the doors open.

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

Shuttle service to and from the Javits Convention Center will be provided from the Hilton all day Tuesday through Thursday. Shuttle pick-up will be from the 53rd Street entrance of the Hilton between 6th and 7th.

Signs will advertise the shuttle schedule, which will begin on Tuesday, January 21. Shuttle service does not operate from hotel to hotel. Shuttles will run from 7:00 am–7:00 pm on Tuesday, 8:00 am – 7:00 pm on Wednesday and 8:00 am – 6:00 pm on Thursday.

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 badge. Wearing a badge is an advertisement that you are a visitor to the city and that you are probably unfamiliar with your location. Walk “smart” when you leave the convention site — know your destination and the best way to reach it. Walk along lighted sidewalks at night and don't walk alone. Trust your instincts — if you're uncomfortable with a situation, get out of it.

Hotel Safety. Some general 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

Policy, fire and medical emergencies call the hotel operator. Hotel security is trained in emergency response and can get to the scene of an emergency quickly if medical assistance is needed.

HOSPITALS

Mount Sinai, 1 Gustave L. Levy Place (212) 241-6500

NYU Langone Medical Center, 550 First Avenue (212) 263-7300

Spouse/Guest Guide

The ASHRAE Lounge is open daily for all individuals who are registered for the meeting. Refreshments are available from 7:30 to 9:30 a.m. each day and beverages are available all afternoon. Members of the New York Host Committee will be present to answer questions about local activities. Detailed information on the city including brochures and maps can be found at the Host Committee Desk located in the ASHRAE Registration area in the Rhineland Gallery, 2nd floor.

Location: Hilton, Concourse A, Concourse Level

Hours

Saturday, January 18 7:30 a.m. – 3:00 p.m.

Sunday, January 19 7:30 a.m. – 4:00 p.m.

Monday, January 20 7:30 a.m. – 4:00 p.m.

Tuesday, January 21 7:30 a.m. – 4:00 p.m.

Wednesday, January 22 7:30 a.m. – 1:00 p.m.

Meet and Greet

MONDAY, JANUARY 20

9:30 a.m. – 11:00 a.m.

The Meet and Greet program is open to all registered spouses and members.

The Immigrant, Radical, And Notorious Women Of Washington Square

Manhattan historian Joyce Gold presents an illustrated talk of Washington Square and the remarkable women who have lived there.

Home to many of the political, creative, and intellectual movements in New York’s history, Washington Square with its amazing female population accounts for much of that vitality.

Perhaps in no other six blocks on earth have so many notable women lived and achieved for the last 150 years. Throughout the years, it has seen an unparalleled variety of women working class, gentry, radical, literary, academic, theatrical, convict, and immigrant. Eleanor Roosevelt, Edith Wharton, Louisa May Alcott, Emily Roebling, Bella Abzug, Gertrude Vanderbilt Whitney, Ida Tarbell, Emily Post, Edna St Vincent Millay, and even the woman who invented the kewpie doll, all shared this famed New York neighborhood.

Highlights of the talk include:

- Literary, art, and theatre iconoclasts
- The salon of Mable Dodge, a center of WW I-era activism
- The tragedy of the Triangle fire and its role in the labor movement
- The Suffrage Movement

About Joyce Gold

Joyce Gold is a recognized expert and educator in New York history for over 25 years, guiding New Yorkers and visitors alike to rave reviews. Joyce will be the tour guide for many of the New York general tours.

Future ASHRAE Meetings

Winter	Date	Annual
New York January 18–22	2014	Seattle June 28–July 2
Chicago January 24–28	2015	Atlanta June 27–July 1
Orlando January 23–27	2016	St. Louis June 25–29

Past ASHRAE Meetings

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

PLENARY SPEAKER

Saturday, January 18



Mark Sanborn is the president of Sanborn & Associates, Inc., an idea lab for leadership development. Leadershipgurus.net lists Sanborn as one of the Top 30 leadership experts in the world.

In addition to his experience leading at a local and national level, Sanborn has written or co-authored eight books, and is the author of more than two dozen videos and audio training programs on leadership, change, teamwork and customer service. He has presented over 2,400 speeches and seminars in every state and a dozen countries.

Sanborn's book, *The Fred Factor: How Passion in Your Work and Life Can Turn the Ordinary into the Extraordinary*, is an international bestseller and was on the New York Times, Business Week and Wall Street Journal bestseller lists. The long awaited sequel, *Fred 2.0* was released in spring 2013, offering the millions of *Fred* fans new stories, illustrations and insights to create more customer loyalty, innovative products, services and experiences. His other popular books include *You Don't Need a Title to be a Leader: How Anyone, Anywhere Can Make a Positive Difference*; *The Encore Effect: How to Achieve Remarkable Performance in Anything You Do*; and *Up, Down or Sideways: How to Succeed When Times are Good, Bad or In Between*.

Sanborn is a member of the prestigious Speakers Roundtable, a society composed of 20 of the top speakers in the world today. He holds a Certified Speaking professional designation from the National Speakers Association and is a member of the Speaker Hall of Fame (CPAE).

Sanborn is a past president of the National Speakers Association and winner of The Cavett Award, the highest honor bestowed by that organization. In 2007, Sanborn was awarded The Ambassador of Free Enterprise Award by Sales & Marketing Executives International.

WELCOME PARTY

Saturday, January 18
6:30–8:30 p.m.

The Rock Center Café, Rockefeller Plaza

Rockefeller Center, in the heart of Manhattan just off of fashionable Fifth Avenue, plays host to the kind of grand Welcome Party that could only be found in New York City. The lavish event offers flowing champagne and premium drinks with a continuous beverage service; savory passed hors d'oeuvres; a fine spread of gourmet entrees, pastas and salads; and a delectable dessert buffet and passed sweets. Best of all, the venue offers the finest view in the city of the iconic ice skating rink at Rockefeller Center; for a small fee, guests may don a pair of skates and also partake of this celebrated New York City winter tradition. Rockefeller Center is just a short five-minute walk from the Conference hotel and is truly a unique New York experience that's not to be missed. Bundle up for the weather to make the short walk from the hotel. **Ticket required. \$77**

Directions

- Exit Hilton on 6th Avenue and walk south to W 50th St.
- Cross 6th Avenue and proceed east on W 50th, enter 30 Rock at the Rainbow Room marquee 1/3 of the way down the block.
- Go down hallway and take the escalator down to the concourse level and the entrance to the party will be straight ahead.

MENU: Continuous Beverage Service featuring a Premium Bar, Red and White Wine, Imported and Domestic Beer, Champagne, Soft Drinks, Juice, Sparkling Water

Passed Hors D'oeuvres

Fennel Marinated Feta Cheese, Mint Leaf and Nicoise Olive Skewers

Tiny Rosemary Popovers with Braised Beef Short Ribs

Fingerling Potatoes with Crème Fraiche and Caviar Savory Cones with Ahi Tuna Tartare, Sesame Oil and Chervil

Seared Beef Nigiri with Wasabi Cream

Herb Crusted Grilled Chicken Satay's

Buffet

Herb-Crusted Tenderloin of Beef, Cabernet Reduction

Roasted Boneless Chicken Breast Stuffed with Asparagus, Goat Cheese and Wilted Spinach

Rotelle Pasta with Salsa Cruda and Ricotta Salata

Roasted Zucchini Provencal, Brioche Breadcrumbs, Parsley, Garlic & Olive Oil

Medley of Roasted Potatoes with Balsamic Glazed Onions

Spinach, Watercress and Red Oak Salad

Assorted Rolls

Dessert Buffet

Apple-Date Crumble

Chocolate Dome with Raspberry Caramel

Coffee and Tea

RESTAURANTS WITHIN WALKING DISTANCE OF THE HILTON

A small sampling of some of the many restaurants near the Hilton.

Le Pain Quotidien

Sandwiches, Vegetarian-Friendly, Bakery,

Coffeehouse (\$23)

922 7th Avenue (7th & W 58th)

212-757-0775

Great for lunch and for a “fresh” and “healthy” “light bite”, this “dependable” Belgian bakery/cafe mini-empire makes it happen with “fine breads and pastries”, “wake-you-up” coffee and other “feel-good” basics; communal tables bolster the “rustic” vibe, and although “slow” service is typical, at least there’s a location “wherever you turn.”

Molyvos

Greek, Seaford (\$59)

871 7th Avenue (btwn 55th & 56th)

212-582-7500

An “oh-so-convenient location” to Carnegie Hall and City Center is one of the draws at this “perennial favorite” that follows through with “delicious” Greek grub and “amiable” service; “nice decor”, “bearable” acoustics and a “spacious-by-Manhattan-standards” setting complete the “solid” picture.

Sushiya

Japanese, Sushi (\$38)

28 W 56th Street (btwn 5th & 6th)

212-247-5756

“Solid” sushi at “affordable” rates keeps the lunch hour “busy” at this Midtown Japanese “business” standby; ok, it’s “not hoity-toity”, but the “fanfare-free” milieu makes for a “pleasant” everyday repast, and you can’t beat the “great location.”

Emmett O’Lunney’s Bar & Grill

American (Traditional), Irish, Bar Food, Fish & Chips

210 W 50th Street (Btwn Broadway & 8th Ave)

212-957-5100

A “convenient” Theater District location draws a “mix of tourists and after-workers” to this double-decker Irish tavern where a “friendly” atmosphere and flat-screen sports add up to one heck of a “good time.”

McGee’s

Pub, Irish, Bar Food

240 W 55th St (btwn Broadway & 8th Ave)

212-957-3536

Whether for a nooner snort, a “nightcap” or surprisingly good pub grub, this Midtown Irish mega-pub is “not crazy busy” and has an “attentive” staff at the ready; the three-floor, fireplace-equipped setup draws a “mixed crowd” of after-workers and theatergoers.

The Capital Grille at the Time-Life Building

Steakhouse, Seaford (\$71)

120 W 51st (btwn 6th & 7th Ave)

212-246-0154

Whether for “corporate” or “celebratory” dining, this “higher-end” steakhouse threesome does it right with “superbly prepared cuts” and “dedicated” service that make it “easy to forget it’s a chain”; the Chrysler Center locale stands out for “stunning decor” with “swooping glass overhead”, but all are “reliably good” – especially when “someone else is paying.”

Ruth’s Chris Steak House

Steakhouse (\$74)

148 W 51st St (btwn 6th & 7th)

212-245-9600

A slather of “melted butter” adds some “extra-fab” sizzle to the “big cuts” of beef at this “first-rate” Theater District link of the New Orleans–based steakhouse chain; likewise, the “personalized” service and “upscale” woodwork are as “impressive” as the tabs are “high.”

Empire Steakhouse

Steakhouse (\$68)

36 W 52 Street (btwn 5th & 6th)

212-582-6900

Carnivores commend the “tender”, “top-notch” steaks at this “busy” chophouse from the Ben & Jack’s folks, “conveniently located” near Rock Center; “attentive” service contributes to the generally “pleasant” vibe, even if the decor doesn’t rise above “standard Midtown.”

Il Melograno

Italian (\$32)

501 W 51st (at 10th Ave)

212-757-9290

It’s “worth the walk to 10th Avenue” say fans of the “delicious” Italian fare served at this “cute” West 50s “neighborhood gem”; a “charming”, “wonderful staff” and “reasonable prices” further explain why it’s “always packed.”

Basso56

Italian (\$51)

234 W 56th Street (56th and Broadway)

212-265-2610

An “excellent Carnegie Hall resource”, this Midtown Italian features a “nicely put-together menu” with “modern flair” ferried by an “accommodating” team; some sniff at the “narrow”, “nothing-fancy” setting, but admit the prices are “reasonable for the quality.”

Il Tinello

Italian (\$75)

16 W 56th Street (btwn 5th & 6th)

212-245-4388

“Serenity” reigns at this Midtown “grande dame” exuding “senior appeal” and patrolled by “conscientious” waiters in “black tie”; everyone agrees that the Northern Italian cooking is “superb”, but given the “corporate-checkbook” tabs, many save it for “special occasions.”

Brasserie 8 1/2

French, New American (\$61)

9 W 57th St (btwn 5th & 6th)

212-829-0812

“Glamorous” is the word for this Midtown brasserie accessed via a “Gloria Swanson”-style “grand stairway”, where the equally “spiffy” French fare is served in a room lined with artwork by “Matisse and Leger”; it’s “sedate” enough for “conversation without shouting”, though very “active at the bar” after work.

AWARDS PRESENTATION

Saturday, January 18, 3:15-5:30 p.m.
Plenary Session, New York Hilton
Grand Ballroom

ASHRAE PIONEERS OF INDUSTRY AWARD

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

John Gorrie
Alfred R. Wolff

STUDENT DESIGN PROJECT COMPETITION

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

HVAC System Selection

First Place: **Garrett Elder, Nathan Thomas Love, Nick Theimer**
Kansas State University
(Faculty Advisors: Julia Keen and Fred Hasler)

HVAC Design Calculations

First Place: **Jayson Bursill, Natasha Palmer, Angela Walton, Gavin Wong**
University of British Columbia (Faculty Advisor: Geoff McDonell)

Applied Engineering Challenge

First Place: **Brian Kaufman, Nicholas Leebug, Tony Lin, Micah Joseph Reich**
San Jose State University (Faculty Advisor: Dr. Nicole Okamoto)

Integrated Sustainable Building Design

First Place: **Jiayi Qiu, Dalin Si, Zhongzhe Wu, Yukai Wu, Ruijun Zhang, Zhiang Zhang, Xuyang Zhong**
University of Nottingham–UK (Faculty Advisor: Edward Cooper)

TECHNOLOGY AWARDS

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

First Place and Award of Engineering Excellence

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

Category I – Commercial Buildings – NEW

Peter Rumsey, for Packard Foundation Net Zero Energy Headquarters
Owner, The David and Lucile Packard Foundation

Category I – Commercial Buildings – Existing

David L. Budd, P.E. for SIERR Building at McKinstry Station
Dean Allen, Owner, McKinstry

Category IV – Industrial Facilities or Processes – Existing

Gheorghe Mihalache, Ph.D., P.Eng. for Fromagerie des Basques
Yves Pettigrew, Owner, Fromagerie des Basques

Category VI – Residential – NEW

Darren S. Dageforde, P.E. for Dageforde Residence
Karen & Darren Dageforde, Owners

Category II – Educational Facilities – NEW

Stephen A. Hamstra, P.E., for 300 Davis Street Building
Owner, University of Findlay

Category V – Educational Facilities – NEW

Stephanie N. Febles, for Locust Trace AgriScience Farm
Owner, Fayette County Public Schools

ASHRAE DISTINGUISHED PUBLIC SERVICE AWARD

“Given in recognition of distinguished public service”

Jeff Gatlin, P.E.
Hernando, MS

E.K. CAMPBELL AWARD OF MERIT

presented by the Life Members’ Club
“Given in recognition of outstanding service and achievement in teaching”

Jeffrey D. Spitler, Ph.D., P.E.
Stillwater, OK

MILTON W. GARLAND COMMEMORATIVE REFRIGERATION AWARD FOR PROJECT EXCELLENCE

“Given in recognition of a non-comfort cooling refrigeration application which highlights innovation and/or new technologies”

Cameron E. Lowry, P.Eng.
Burnaby, BC, Canada

ASHRAE FELLOWS

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

Roberto R. Aguilo, P.E., Buenos Aires, Argentina
David J. Branson, P.E., Lubbock, TX
J. Steven Brown, Ph.D., P.E., Washington, DC
Thomas A Butcher, Ph.D., Port Jefferson, NY
Stephen W. Duda, P.E., St. Louis, MO
D. Y. (Yogi) Goswami, Ph.D., P.E., Tampa, FL
Edison T. Guimaraes, P.E., Rio de Janeiro, Brazil
M. Dennis Knight, P.E., ASHRAE-Certified Building Energy Modeling Professional
Gerhard W. Knutson, Ph.D., Edina, MN
Chao-Hsin Lin, Ph.D., P.E., Redmond, WA
Richard Lord, Murfreesboro, TN
Paul C. Miclea, P.E., Walnut Creek, CA
Gregory F. Nellis, Ph.D., Madison, WI
Jianlei Niu, Ph.D., P.E., Hungghom, Kowloon, Hong Kong
James K. Vallort, Chicago, IL

ASHRAE HALL OF FAME AWARD

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

Fred W. Wolf, Jr.

F. PAUL ANDERSON AWARD

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

Presidential Member **Kent W. Peterson, P.E.**
Long Beach, CA

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. Most meetings are scheduled in the New York Hilton with some meetings scheduled at the New York Sheraton.

To get to the Sheraton, exit the Hilton New York from the Lobby Level exit located near the front desk or through the exit to the parking garage to 53rd Street. The Sheraton's address is 711 7th Avenue on 53rd Street. The Sheraton is across the street from the Hilton on 53rd. Please note that there are some room names that are the same or similar to rooms in the Hilton. One example is Madison. If it is the Madison in the Hilton there will be no number associated with it and there will be an (H) for Hilton next to the room name. If it is Madison 1 to 6 it is the Sheraton with an (S).

CONFERENCE REGISTRATION

Rhineland Gallery, 2nd floor

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 17	10:00 a.m.–5:00 p.m.
Saturday, January 18	7:15 a.m.–6:00 p.m.
Sunday, January 19	7:00 a.m.–5:00 p.m.
Monday, January 20	7:00 a.m.–5:00 p.m.
Tuesday, January 21	7:30 a.m.–4:30 p.m.
Wednesday, January 22	7:30 a.m.–11:00 a.m.

Computers with internet access will be available for E-mail. Online registration is available 24/7. If you register on line just come to ASHRAE registration to pick up your badge or tickets.

ASHRAE BOOKSTORE

Promenade, 2nd floor

More than 300 books, conference papers, and other recent publications will be available for purchase in the ASHRAE Bookstore. The bookstore provides HVAC&R technical literature from ASHRAE and other publishers. The ASHRAE Bookstore will be open during the following hours:

Friday, January 17	10:00 a.m.–5:00 p.m.
Saturday, January 18	7:15 a.m.–6:00 p.m.
Sunday, January 19	7:00 a.m.–5:00 p.m.
Monday, January 20	7:00 a.m.–5:00 p.m.
Tuesday, January 21	7:30 a.m.–4:30 p.m.
Wednesday, January 22	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.

AHR EXPO®

Jacobs Javits Convention Center, 655 W. 34th Street

Hours:

Tuesday, January 21	10:00 a.m.–6:00 p.m.
Wednesday, January 22	10:00 a.m.–6:00 p.m.
Thursday, January 23	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 Javits Convention Center. **Registration for the AHR Expo® will be open from Noon to 4:00 p.m. on Monday, January 20. Starting Tuesday, you can register one hour before the doors open.**

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

Shuttle service to and from the convention center will be provided from the Hilton all day Tuesday through Thursday. Shuttle pick-up will be from the 53rd Street entrance between 6th and 7th. Exit to 53rd from the exit near the hotel registration desk or the parking garage. Shuttle service will run from 7am–7pm and will run approximately every 10 minutes. Signs will advertise the shuttle schedule, which will begin on Tuesday, January 21. Shuttle service does not operate from hotel to hotel. Shuttles will run from 7:00 am–7:00 pm on Tuesday, 8:00 am–7:00 pm on Wednesday and 8:00 am–6:00 pm on Thursday.

AHR BAR CODES

Exhibitors will scan your badge if you have interest in receiving product information from an exhibitor. This is another step toward greening our events. Contact information provided on the bar code may be distributed to all AHR exhibitors but only includes name and mailing address. No emails are captured.

ALI COURSES

Registration for the ASHRAE Learning Institute courses being held at the Javits Convention Center is available at either the ASHRAE registration at the Hilton or at Javits, Crystal Palace, one level up from the South or North Concourse. Registration will open at Javits Convention Center on Sunday from 12:00 p.m.–3:00 p.m., Monday 7:30 a.m.–4:00 p.m., Tuesday 8:00 a.m.–6:00 p.m., Wednesday 8:00 a.m.–6:00 p.m., Thursday 7:00 a.m.–12:00 p.m. Online registration will close at midnight on the evening prior to the course.

ASHRAE LOUNGE

Concourse A, Concourse Level

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

This room will be open during the following hours:

Saturday, January 18	7:30 a.m.–3:00 p.m.
Sunday, January 19	7:30 a.m.–4:00 p.m.
Monday, January 20	7:30 a.m.–4:00 p.m.
Tuesday, January 21	7:30 a.m.–4:00 p.m.
Wednesday, January 22	7:30 a.m.–1:00 p.m.

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

TOURS

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

SPEAKERS' LOUNGE

Rhineland Gallery, 2nd floor

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

Saturday, January 18	1:00 p.m.–3:00 p.m.
Sunday, January 19	7:00 a.m.–5:00 p.m.
Monday, January 20	7:00 a.m.–12:15 p.m. and 1:30 p.m.–4:30 p.m.
Tuesday, January 21	7:00 a.m.–5:00 p.m.
Wednesday, January 22	7:00 a.m.–1:00 p.m.

PRESS ROOM

Green Room, 4th floor

The Press Room will be open during the following hours:

Saturday, January 18	8:00 a.m.–3:00 p.m.
Sunday, January 19	8:00 a.m.–3:00 p.m.
Monday, January 20	9:00 a.m.–5:00 p.m.
Tuesday, January 21	9:00 a.m.–3:00 p.m.
Wednesday, January 22	8:00 a.m.–10:00 a.m.

HEADQUARTER OFFICE

Nassau, 2nd floor

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

Friday, January 17	Noon–5:00 p.m.
Saturday, January 18	8:00 a.m.–5:00 p.m.
Sunday, January 19	8:00 a.m.–5:00 p.m.
Monday, January 20	8:00 a.m.–5:00 p.m.
Tuesday, January 21	8:00 a.m.–5:00 p.m.
Wednesday, January 22	8:00 a.m.–1:00 p.m.

MEMBERSHIP INFORMATION DESK

Rhineland Gallery, 2nd floor

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.

YOUNG ENGINEERS IN ASHRAE (YEA)

HOSPITALITY SUITE

Petit Trianon, 3rd floor

Attention members age 35 and younger! You are invited to visit the Young Engineers in ASHRAE (YEA) Hospitality Suite to be held on Sunday, January 19, from 4:00 p.m.–7:00 p.m. The suite offers social and networking opportunities and light refreshments will be available.

A YEA/student mixer will be held Saturday, January 18, from 5:00 p.m.–6:30 p.m. in the Concourse A room of the Hilton on the Concourse Level. Come join us to meet other young ASHRAE members!

LEADERSHIP U

At each ASHRAE conference, the Leadership U program gives four future ASHRAE leaders the opportunity to shadow an ASHRAE Board member, providing a high level conference experience and unique networking opportunity. This program is operated by the Young Engineers in ASHRAE (YEA) Committee and more information can be found at www.ashrae.org/yea. The Leadership U participants for the 2014 ASHRAE Winter Conference are:

Christopher Delgado, Alamo Chapter, Region VIII
Mike Filler, Pikes Peak Chapter, Region IX
Cindy Moreno, San Diego Chapter, Region X
Heather Schopplein, San Diego Chapter, Region X

STUDENT ACTIVITIES

Grand Ballroom East, 3rd floor

Plan to join the Student Welcome and Orientation on Saturday, January 18 from 2:00 p.m.–3:00 p.m. in Beekman, 2nd floor.

The Student Program will be held in the Grand Ballroom East at the Hilton on Sunday, January 19 from 9:00 a.m.–2:00 p.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.

The Student Tour to Hearst Towers will depart from the Hilton lobby level, 54th Street entrance near the gift shop. Tickets are \$15 and may be purchased at the ASHRAE registration in Rhineland.

INVITATION TO ALL NEW MEMBERS, FIRST TIME ATTENDEES AND NON-MEMBERS

Sunday, January 19, 2:30 p.m. to 3:30 p.m.
Petit Trianon, 3rd floor

If you've never attended an ASHRAE conference 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.

NEW YORK HOST COMMITTEE INFORMATION DESK

Rhineland Gallery, 2nd floor

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 New York.

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

SEATTLE CONFERENCE INFORMATION

Rhineland Gallery, 2nd floor

Information on the upcoming Annual Conference June 28–July 2, 2014, in Seattle, WA, will be available in the registration area. Also, information is online at www.ashrae.org/Seattle.

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. Most meetings are scheduled in the New York Hilton with some also scheduled at the New York Sheraton.

The numbers and letters in parenthesis following the room name indicate the floor location within the New York Hilton. (2) Second Floor, (3) Third Floor, (4) Fourth Floor, (C) Concourse Level which is accessible via the elevator in the Hilton Lobby.

Meeting Schedule

FRIDAY, JANUARY 17

- 8:00 am–5:00 pm **Committee Meetings**
See listing on pages 58–72
- 10:00 am–5:00 pm **Registration**, Hilton, Rhinelander Gallery (2)
- 10:00 am–5:00 pm **ASHRAE Bookstore**, Hilton, Promenade (2)

SATURDAY, JANUARY 18

- 7:30 am–3:00 pm **ASHRAE Lounge**, Hilton, Concourse A (C)
- 7:15 am–6:00 pm **Registration**, Hilton, Rhinelander Gallery (2)
- 7:15 am–6:00pm **ASHRAE Bookstore**, Hilton, Promenade (2)
- 8:00 am–3:00 pm **Press Room**, Hilton, Green Room (4)
- 8:00 am–5:00 pm **Committee Meetings**
See listing on pages 58–72
- 1:00 pm–3:00 pm **Speakers' Lounge**, Hilton, Rhinelander Gallery (2)
- 2:00 pm–3:00 pm **Student Orientation**, Hilton, Beekman (2)

Special Event

- 3:15 pm–5:00 pm **Meeting of the Members**,
Plenary Session, Grand Ballroom (3)
Opening and Welcoming Remarks by
ASHRAE President **William P. Bahnfleth**
Welcome by Director and Chair,
Region I, **Joseph L. Furman**
Secretary's Report by Executive Vice
President **Jeff H. Littleton**
Awards Presentation
See page 17 for details
Keynote Address: Mark Sanborn
See page 15 for details
Plenary Session is open, no badge nor
registration is required to attend.
- 5:00 pm–6:30 pm **YEA/Student Mixer**, Concourse A (C)

Special Event

- 6:30 pm–8:30 pm **Welcome Party**, The Rock Center Café,
Rockefeller Center
See page 15 for details

Note: \$77 ticket per person required.

Tickets may be purchased online 24/7 or at the ASHRAE Registration Desk; Pick up your ticket at ASHRAE Registration. Advance-purchase tickets may be picked up at the door if after registration hours.

SUNDAY, JANUARY 19

- 7:00 am–5:00 pm **Speakers' Lounge**, Hilton, Rhinelander Gallery (2)
- 7:00 am–5:00 pm **Registration**, Hilton, Rhinelander Gallery (2)
- 7:00 am–5:00 pm **ASHRAE Bookstore**, Hilton, Promenade (2)
- 7:30 am–4:00 pm **ASHRAE Lounge**, Hilton, Concourse A (C)
- 8:00 am–4:45 pm **Technical Sessions**
See Technical Program on pages 32–57
- 8:00 am–3:00 pm **Press Room**, Hilton, Green Room (4)
- 8:00 am–5:00 pm **Committee Meetings**
See listing on pages 58–72
- 9:00 am–2:00 pm **Student Program**, Hilton, Grand Ballroom East (3)
- 1:00 pm–4:00 pm **General Tour:**
New York TV & Movie Sites
See description on page 22
- 3:30 pm–4:30pm **Technical Tour:** New York Hilton
- 2:30 pm–4:30pm **Student Technical Tour:** Hearst Tower
- 3:00 pm–5:00pm **Student Technical Tour:** Hearst Tower
(Repeat of 2:30 tour)
- 3:30 pm–5:30pm **Student Technical Tour:** Hearst Tower
(Repeat of 2:30 tour)
See descriptions on pages 24–25
- 2:30 pm–3:30 pm **New Member Social**, Hilton, Petit Trianon (3)
- 4:00 pm–7:00 pm **Young Engineers in ASHRAE (YEA)**
Hospitality Suite, Hilton, Petit Trianon (3)
*Attention members age 35 and younger—
you are invited to visit the YEA Hospitality
Suite, offering social and networking
opportunities Light refreshments will
be available.*
See page 19 for more details
- #### MONDAY, JANUARY 20
- 7:00 am–5:00 pm **Speakers' Lounge**, Hilton, Rhinelander Gallery (2)
- 7:00 am–5:00 pm **Registration**, Hilton, Rhinelander Gallery (2)
- 7:00 am–5:00 pm **ASHRAE Bookstore**, Hilton, Promenade (2)

- 7:30 am–4:00 pm **ASHRAE Lounge**, Hilton, Concourse A (C)
- 8:00 am–12:00 pm **Technical Sessions**
See Technical Program on pages 32–57
- 9:00 am–5:00 pm **Press Room**, Hilton, Green Room (4)
- 8:00 am–5:00 pm **Committee Meetings**
See listing on pages 58–72
- 10:15 am–11:45 am **Student Congress**, Hilton, Clinton (2)

Special Event

- 12:15 pm–2:00 pm **President’s Luncheon**
(doors open at noon), Hilton, Grand Ballroom (3)
President **William P. Bahnfleth** 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.
See description on page 23
Note: Ticket required.
- 2:15 pm–4:00 pm **Technical Sessions**
See Technical Program on pages 32–57
- 2:15 pm–5:00 pm **Technical Tour:** Penn Plaza
- 2:15 pm–6:00 pm **General Tour:** Ground Zero
See descriptions on page 22 and 24
- 2:30 pm–3:30 pm **Technical Tour:** New York Hilton
- 3:30 pm–5:00 pm **Technical Tour:** Rockefeller Center
See descriptions on page 24–25
- After 5:00 pm **Regional Dinners**
Sign up in ASHRAE registration area.

TUESDAY, January 21

- 7:00 am–5:00 pm **Speakers’ Lounge**, Hilton, Rhineland Gallery (2)
- 7:30 am–4:30 pm **Registration**, Hilton, Rhineland Gallery (2)
- 7:30 am–4:30 pm **ASHRAE Bookstore**, Hilton, Promenade (2)
- 7:30 am–4:00 pm **ASHRAE Lounge**, Hilton, Concourse A (C)
- 8:00 am–4:45 pm **Technical Sessions**
See Technical Program on pages 32–57
- 9:00 am–3:00 pm **Press Room**, Hilton, Green Room (4)
- 8:00 am–5:00 pm **Committee Meetings**
See listing on pages 58–72
- 10:00 am–6:00 pm **AHR Expo®**, Jacob Javits Convention Center 655 W. 34th Street

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:** No one under 16 admitted; ages 16 and 17 will

be admitted only if accompanied by an adult. **Shuttle service to and from the Javits Convention Center will be provided from the Hilton. Shuttle pick-up will be from the 53rd Street entrance between 6th and 7th. Exit to 53rd from the exit near the hotel registration desk or the parking garage. Shuttle service will run from 7am–7pm and will run approximately every 10 minutes. Signs will advertise the shuttle schedule. Shuttle service does not operate from hotel to hotel.**

See page 18 for more details

- 9:00 am– 12:00 pm **General Tour:** Grand Central Terminal
See description on page 22

- Noon-1:30 pm **Life Members’ Lunch**, Bar Americain, 152 W. 52nd Street
Note: *Ticket required*

- 12:15 pm–2:45 pm **Technical Tour:**
New School University Center

- 12:15 pm–3:00 pm **Technical Tour:** Penn Plaza

- 1:30 pm–4:30 pm **General Tour:** Lincoln Center

- 1:30 pm–5:00 pm **General Tour:** Financial District

- 3:00 pm–4:00 pm **Technical Tour:** New York Hilton

See descriptions on page 22–25

Special Event

- 6:15 pm–7:15 pm **Reception**, Hilton, Grand Ballroom Foyer (3)

- 7:30 pm–10:30 pm **Members’ Night Out**, Hilton, Grand Ballroom (3)
See page 23 for details.

Note: *Ticket required*

WEDNESDAY, JANUARY 22

- 7:30 am–10:00 am **Registration**, Hilton, Rhineland Gallery (2)

- 7:30 am–1:00 pm **ASHRAE Bookstore**, Hilton, Promenade (2)

- 7:30 am–1:00 pm **ASHRAE Lounge**, Hilton, Concourse A (C)

- 7:00 am–1:00 pm **Speakers’ Lounge**, Hilton, Rhineland Gallery (2)

- 8:00 am–10:00 am **Press Room**, Hilton, Green Room (4)

- 8:00 am–12:30 pm **Technical Sessions**
See Technical Program on pages 32–57

- 8:00 am–5:00 pm **Committee Meetings**
See listing on pages 58–72

- 10:00 am–6:00 pm **AHR Expo®**, Jacob Javits Convention Center 655 W. 34th Street
See page 18 for more details

THURSDAY, JANUARY 23

- 10:00 am–6:00 pm **AHR Expo®**, Jacob Javits Convention Center 655 W. 34th Street
See page 18 for more details

GENERAL TOURS

Tour tickets may be purchased at the ASHRAE Registration desk in the Hilton, Rhinelander Gallery, 2nd floor of the hotel or online 24/7.

Please note that some of the tours are walking tours, others will use either a bus for transportation or the subway. Subway tickets will be pre-purchased for you and each tour has a guide.

All tours depart from the 54th Street entrance of the Hilton (lobby level past the gift shop). Tours will depart promptly at the times indicated.

Stand-by tour tickets are distributed at ASHRAE registration after a tour sells out. Stand-by tickets are provided to ensure that a tour is filled in the event of 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 before the tour departs.

New York Television and Movie Sites Tour

Sunday, Jan. 19

1–4 p.m.

Cost: \$40

Lights! Camera! Action! This tour gives you a new way to see the Big Apple, the most filmed city in the world, and provides a front row seat to the best New York City landmarks; from the Empire State Building to Times Square to Central Park to Grand Central Station. The tour takes you off the beaten path to neighborhoods like SoHo, the Meatpacking District, Greenwich Village, Tribeca and the Upper East Side.

The licensed tour guides are all local actors and actresses who provide insider perspectives and anecdotes about filming on location.

WHAT YOU'LL SEE ON TOUR

Get a look at more than 40 of New York City's best filming locations, featured in television shows and movies:

- See where the cast of *Glee* performed “I Love New York”
- Visit the apartment building from “Friends”
- Stop at the brownstone used in “I Am Legend”
- Spot The Original Soup Man featured on “Seinfeld”
- Catch a glimpse of the Daily Bugle offices in “Spider-Man”
- Pass the hotel that doubled for a Paris hotel in “The Devil Wears Prada”
- Visit McGee’s Pub, the inspiration for MacLaren’s in “How I Met Your Mother”

Transportation for this tour is by bus

Ground Zero

Monday, Jan. 20

2:15–6 p.m.

Cost \$37

NOTE: This tour will require a photo ID. Please have your driver’s license or passport with you.

Recovery from the Sept. 11, 2001, attack has redefined Lower Manhattan. The monumental task of redesigning the World Trade Center site has epitomized the struggle among competing interests vying for influence and control over this historic re-working of Manhattan’s oldest district. Site by site, developers, governments, 9/11 families, growing numbers of residents, the business community and others have all clashed and compromised to redefine the future there.

How is the area changing? Will the new neighborhood be an improvement? Will the new architecture uplift our sense of purpose and the perception of the tragedy? What memorials and memories will remain of 9/11? Will tourists overwhelm the neighborhood? How will security measures affect the atmosphere of the newly diversified district? These are some of the issues that you can explore on this challenging new tour.

Grand Zero tour will utilize the subway for transportation to the site. Subway tickets will be pre-purchased and an escort will go with the group on the subway. Dress for the weather.

Grand Central Terminal

Tuesday, Jan. 21

9 a.m.–Noon

Cost: \$57

One-hundred years ago, Grand Central Terminal opened to great acclaim. More than 150,000 people visited it on opening day. The dramatic new structure was a thrilling symbol of the fast-expanding commercial and intellectual reach of the second largest city in the world.

A majestic Beaux Arts rendition of a classical form, Grand Central is impressive outside and within. A monumental sculpture crowns its 42nd Street façade. The Main Concourse has the soaring dimensions of a cathedral. The building seems to embody the huge purpose of the terminal—to move great numbers of people, to provide services for travelers, to outshine its rival, and to create a real estate boom with the innovation of air rights.

ADDITIONAL HIGHLIGHTS OF THE WALK INCLUDE:

- the tragedy that led to its creation
- design that made traffic flow and luggage glide
- its history-making role in landmarking New York City’s heritage
- the Campbell Apartment
- the Whispering Arch

Transportation for this tour is by bus

Financial District

Tuesday, Jan. 21

1:30–5 p.m.

Cost: \$32

This walking tour celebrates the 400th anniversary of Henry Hudson’s sail into New York Harbor, claiming the area for the Dutch East India Company. It highlights New York City’s earliest years, the company that put down the first roots, the people who came and lived here, and the natives already here when the settlers arrived. The Dutch settlement lasted just 40 years, from 1624 to 1664. And yet these origins still shine through in this city, one of the greatest business centers in the world.

TOUR HIGHLIGHTS:

- Original shore line and geography of Manhattan
- Discussion of the implication that Dutch business, not the Dutch government, founded New Amsterdam
- Important sites of Dutch defenses and communal needs
- Discussion on why the company relinquished New Amsterdam after just 40 years
- Peter Styvesant and his legacy to New York

Dress for the weather as this is a walking tour

Lincoln Center

Tuesday, Jan. 21

1:30–4:30p

Cost: \$72

Considered the world’s premier performing arts center, learn more about Lincoln Center’s iconic landmarks, including the Revson Fountain, the newly transformed Alice Tully Hall and the Metropolitan Opera House, which have been showcased on “Sex and the City” and in movies, “Black Swan,” “Moonstruck” and “Ghostbusters.”

Go behind the scenes at venues where a spectacular range of artists have performed, including Luciano Pavarotti, Mikhail Baryshnikov, Leonard Bernstein, Renée Fleming and Bruce Springsteen.

Each tour is unique, and you never know what might happen. You might sit in on a rehearsal, walk out onto a stage or meet a star.

Transportation for the tour will be by bus.

PRESIDENT’S LUNCHEON

Monday, January 20, 12:15 pm–2:00 pm

Hilton, Grand Ballroom, 3rd floor

President William P. “Bill” Bahnfleth invites you to join him at the Presidential Luncheon where he updates attendees on this theme Shaping the Next. Major Research Promotion Investors will be recognized. Doors open at noon.

Menu:

Mixed Baby Green Salad

Roasted Farm Chicken

Spring Pea Risotto Cake with Roasted Garlic

Black Forest Cake Dome

Ticket Required. \$47

MEMBERS NIGHT OUT

Tuesday, January 21

Hilton, Grand Ballroom

Cash Bar Reception, 6:15–7:15 p.m., Ballroom Foyer

Dinner, 7:15–8:30 p.m.

Entertainment 8:30–10:30

You don’t have to take a trip to the theatre district for upscale entertainment. Members Night Out brings you everything you could ever want from a night on the town—fine dining, live music, a sophisticated venue. A live band and dazzling singer entertains you with big band music and hits from the 70s, 80s and today. Enjoy the passionate singing and music, but you won’t be able to resist getting up to dance.

Attire: Dressy casual or formal wear recommended.

Menu:

Romaine Heart Wedge

Filet Mignon

Blue Cheese Scalloped Potato

Bittersweet Chocolate Bombe

Wine served with dinner

Ticket required. \$57

TECHNICAL TOURS

Tour tickets may be purchased at the ASHRAE Registration desk in the Hilton, Rhinelander Gallery, 2nd floor of the hotel or online 24/7.

Please note that all of the tours are either walking tours or will use the subway for transportation.

All tours depart from the 54th Street entrance of the Hilton (lobby level past the gift shop). Tours will depart promptly at the times indicated.

Stand-by tour tickets are distributed at ASHRAE registration after a tour sells out. Stand-by tickets are provided to ensure that a tour is filled in the event of 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 before the tour departs.

NOTE: All tours will require a photo ID, driver's license or passport.

Student Technical Tour – Hearst Tower

Sunday, Jan. 19

2:30pm–4:30pm

3:00pm–5:00pm (repeat of 2:30 tour)

3:30pm–5:30pm (repeat of 2:30 tour)

Cost: \$15

Hearst Tower is the first “green” high rise office building completed in New York City, with a number of environmental considerations built into the plan. The floor of the atrium is paved with heat conductive limestone. Polyethylene tubing is embedded under the floor and filled with circulating water for cooling in the summer and heating in the winter. Rain collected on the roof is stored in a tank in the basement for use in the cooling system, to irrigate plants and for the water sculpture in the main lobby. 85% of the building's structural steel contains recycled material. Overall, the building has been designed to use 26% less energy than the minimum requirements for the city of New York, and earned a gold designation from the United States Green Building Council's LEED certification program, becoming New York City's first LEED Gold skyscraper.

Members of the design team (Flack & Kurtz), the Chief Engineer and the Property Manager will be part of the tour. The building is centrally located within walking distance from the New York Hilton, ASHRAE's headquarter hotel.

Rockefeller Center's District Cooling Plant (SOLD OUT)

Monday, Jan. 20

3:30–5 p.m.

Cost: \$27

The Tishman Speyer Rockefeller Center central refrigeration plant, building management system and ice storage facility is cutting edge in commercial building refrigeration efficiency. The central refrigeration plant is the heart of the air-conditioning system and has 14,500 tons of cooling capacity. The overall system is capable of pumping 22,000 gallons per minute of chilled water which cools over 6 million square feet of commercial and retail space.

The central plant consists of three electrical drive units and one steam turbine driven system. These units create the chilled water which is pumped to over 560 independent air handlers across 12 buildings. All systems are continually monitored through a state of the art building management system that supervises every control point and alarm condition. The plant operates 24/7 to supply chilled water to the base building air systems and tenant supplemental cooling equipment for data centers and conference rooms. There are two 10,000 ton condenser water systems that support the central plant.

In 2008 Rockefeller Center added an Ice Storage Chiller Plant to reduce overall electric peak demand at the property complex during prime operating hours. The ice making and storage plant is located in a former storage area within the Rockefeller Center loading dock. The ice plant operates during off peak hours creating approximately 750,000 lbs. of ice, in 41 storage vessels, providing over 8,000 ton hours of ice storage.

This tour is within walking distance

One Penn Plaza Cogeneration Plant Tour

Monday, Jan. 20

2:15–5 p.m.

Tuesday, Jan. 21

12:15–3 p.m. (Repeat of tour on Monday)

Cost: \$27

Vornado Realty Trust's 6.2 MW cogeneration project at One Penn Plaza (“Peak Power One”), one of the largest cogeneration plants at an existing commercial office building in New York City, began operation in 2010.

The state of the art combined heat and power (CHP) system consists of three 2.055 MW reciprocating engines, and three heat recovery steam generators (HRSGs), all housed in a sound attenuated enclosure. The turnkey CHP system is installed on an open setback roof atop the low rise portion of the building. The generators tie in to the main building electrical services. Waste heat from the engines are processed through the HRSGs to produce high pressure steam, which is then used to offset the building's steam load, used in summer months to cool the building using steam turbine chillers and in the winter months to preheat domestic water and condition the temperature of secondary water.

Peak Power One CHP produces 20 25 million kwh per year (approximately 50 percent of the electricity at peak) and 30 percent of the steam requirements. By capturing waste heat from the engine generators and reusing it to power both heating and cooling systems for the building, the system achieves a combined efficiency of more than 70 percent, approximately double the efficiency of conventional power supplied by the grid. The project helps meet NY State's initiative for a 15 percent energy reduction by 2015 (the New York State Energy Efficiency Portfolio Standard) and Mayor Bloomberg's PlaNYC 2030 mandate of 30 percent reduced greenhouse emissions by 2030, as well the goal to add 800 MW of distributed generation to New York City.

This tour will utilize the subway for transportation to the site. Subway tickets will be pre-purchased and an escort will go with the group on the subway.

The New School University Center

Tuesday, Jan. 21

12:15–2:45 p.m.

Cost: \$27

This project at 14th Street and 5th Avenue is a 370,000 square foot mixed use building in construction near Union Square. Several architectural, structural, façade and mechanical innovations and unique conditions are featured including ice storage, black-water treatment and a commercial building combined heat and power (CHP) system. The building is achieving 32 percent reductions below 90.1-2007 (in design).

This tour will utilize the subway for transportation to the site. Subway tickets will be pre-purchased and an escort will go with the group on the subway.

New York Hilton

Sunday, Jan. 19

3:30–4:30 p.m.

Monday, Jan. 20

2:30–3:30 p.m.

Tuesday, Jan. 21

3–4 p.m.

Cost: \$17

Located at the heart of midtown, the Hilton is one of the largest hotels in New York City. It is supported by a 3,200 ton cooling system consisting of cooling towers, centrifugal chillers with a primary and secondary chilled/hot water distribution system to perimeter fan coil units and air handlers for common spaces. High pressure steam is delivered to the premises and the hotel steps it down to low pressure steam for domestic hot water and heating use. In the early 2000s, the Hilton installed a 150kW fuel cell to manage peak demand usage and in 2013 they installed a 1.6 MW CHP system.

Javits Convention Center

Tuesday, Jan. 21

2:30–4:00 p.m.

Cost: \$15

After thirty years of intense use and deferred maintenance, the new Javits Center is now a revitalized, reinvigorated, state-of-the-art facility. The projected LEED Silver project includes a complete renovation and modernization, a northward expansion, and a comprehensive sustainability strategy. The building's appearance, systems, urban linkages, and day-to-day performance have been transformed, while the original space frame and overall functionality have been maintained. The Javits Center is not a structure that lends itself to easy modification since its components are either cast concrete or supported by the unalterable space frame. The team found innovative solutions to design concerns as well as creative approaches to State and City sustainability requirements. The renovated interior spaces have considerably more natural light, better indoor air quality, operational efficiency, and adaptability. The facility is projected to reduce energy consumption by more than 26%. A new high-performance curtain wall has simplified and lightened the aesthetics of the original façade by changing the façade's module from five-by-five-foot to five-by-ten-foot. This allowed for the introduction of more transparent glass with minimal, structurally glazed mullions. Solid stainless steel panels replaced the opaque portions of glass to better express the building's functionality. A 6.7-acre green roof—the second largest in the United States—mitigates the heat-island effect of the building, increases thermal performance, helps protect the roof membrane, reduces storm-water runoff by an average of 40 percent, enhances the aesthetics of the building when seen from above, and creates a natural wildlife habitat.

Bruce Fowle, Founding Principal at FXFOWLE Architects and **David Choy**, Senior Vice President, Building Systems, WSP, New York will lead the tour.

Javits shuttle pick-up will be from the 53rd Street entrance between 6th and 7th. Exit to 53rd from the exit near the hotel registration desk or the parking garage. Shuttle service will run from 7am–7pm and will run approximately every 10 minutes.

notes

ASHRAE 2014 WINTER CONFERENCE COURSES –

Full-Day Seminars & Half-Day Courses for In-Depth Instruction

All ASHRAE Learning Institute (ALI) training will be held at the New York Hilton or Javits Center. Each training session will carry Continuing Education Units (CEUs), Professional Development Hours (PDHs), and/or American Institute of Architects Learning Units (AIA LUs), and Green Building Certification Institute (GBCI) credits which can be applied toward maintaining your P.E. licensure.

Registration for the ASHRAE Learning Institute training sessions being held at Javits Center can be done at either ASHRAE registration at the New York Hilton or at Javits Center. Registration will open at Javits Center on Sunday from 12:00 p.m.–3:00 p.m., Monday from 7:30 a.m.–4:00 p.m., Tuesday from 8:00 a.m.–6:00 p.m., Wednesday from 8:00 a.m.–6:00 p.m., and Thursday from 7:00 a.m.–12:00 p.m. Online registration will close at midnight on the evening prior to the course.

Shuttle Service for the courses on Tuesday through Thursday will operate all day from the New York Hilton to Javits Center.

Please refer to the map in this program to assist in finding the rooms for the ALI Courses.

FULL-DAY PROFESSIONAL DEVELOPMENT SEMINARS

Registration fees: \$485 per course; \$395 for ASHRAE members. Completion of each seminar earns 6 PDHs/AIA LUs or .6 CEUs (*check with your state for their continuing education credit requirements*)

SATURDAY, JANUARY 18, 2014

Commercial Building Energy Audits (code 60)

**8:00 am–3:00 pm, New York Hilton,
Room: Sutton Center, 2nd floor**



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

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

Healthcare Facilities: Best Practice Design and Applications (code 61)

**8:00 am–3:00 pm, New York Hilton,
Room: Sutton South, 2nd floor**

Based on the ASHRAE book *HVAC Design Manual for Hospitals and Clinics*, this seminar introduces many unique and up-to-date healthcare design considerations and applications. The seminar covers chapters 1–4, 6–11, and 13–16. During the first half of the seminar, common medical terminology is introduced and how some

terms have very different meanings between the medical and engineering communities will be explained. Infection particles and their transport mechanisms are covered, followed by infection control methods. A major emphasis is on the necessary considerations for various diagnostic and treatment and support areas. The second half of the seminar focuses on air distribution designs for surgical and patient rooms. Various control and energy efficiency techniques for cooling and heating plants are presented along with O&M and other commissioning topics. Lastly, smoke control and life safety best practices and application issues finish the seminar.

Instructors: Robert L. Cox, P.E., Member ASHRAE; Daniel Koenigshofer, P.E., Member ASHRAE, HFDP; and Michael Sheerin, P.E., Member ASHRAE

TUESDAY, JANUARY 21, 2014

Energy Modeling Best Practices and Applications (code 72)

(Co-sponsored by IBPSA-USA and RMI)

9:00 am–4:00 pm, Javits Center, Room: 1C03

This seminar focuses on topics critical to the effective delivery of energy modeling services, including modeling fundamentals, modeling best practices and quality control, and modeling to inform design, measurement and verification. This seminar presents case studies and discusses modeling tools for streamlining quality control procedures and the development of input data for building characterization.

Instructors: Erik Kolderup, P.E., Member ASHRAE, BEMP, LEED® AP; and Annabel Marston, Ph.D., BEMP, LEED® AP

Significant Changes to Standard 90.1-2010 and IECC 2012 (code 73)



(Co-sponsored by ICC)

9:00 am–4:00 pm, Javits Center, Room: 1C01

ANSI/ASHRAE/IES Standard 90.1-2010 and the 2012 International Energy Conservation Code (IECC) mark an acceleration in the race to reduce energy usage in commercial buildings. More than three times the typical number of addenda has been added to these editions, marking the largest change in a decade. This seminar provides an in-depth overview of these publications, answering the questions: “What changed from their previous editions?” and “When comparing them, how are the Code and the Standard alike, and how do they differ?” Changes to the envelope, lighting and mechanical sections in both editions are discussed, using as a basis the new publication, *Significant Changes to the International Energy Conservation Code and ANSI/ASHRAE/IES Standard 90.1*. A complimentary copy of this publication will be provided to course registrants.

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

WEDNESDAY, JANUARY 22, 2014

Effective Energy Management in New and Existing Buildings (code 77)

9:00 am–4:00 pm, Javits Center, Room: 1C03

Buildings use 41% of US energy, of which one-third can be practically saved. This seminar discusses the principles of energy management, and also includes example problems which are solved collaboratively by the class. This reinforces key points in the presentation, and results in a more in-depth learning experience.

Students will learn emission factors in different geographic regions and how to develop the carbon footprint of a building. At the completion of this seminar, students will be prepared to evaluate a reduced emissions program and the cost effectiveness produced by key energy management practices.

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

THURSDAY, JANUARY 23, 2014

Complying with Standard 90.1-2013 (code 80)



8:00 am–3:00 pm, Javits Center, Room: 1C01

Since 1975, the various versions of Standard 90.1 have been the benchmarks for commercial building energy codes in the United States and a key basis for standards in more than 15 countries around the world. The 2013 update of Standard 90.1 is a major revision, containing more than 100 changes from the 2010 version. Standard 90.1-2010 and 90.1-2013 together produce 50% energy savings from the 2004 version. By substantially surpassing the Standard 2013 requirements, buildings should achieve well over 50% energy savings. This seminar is highly interactive and includes several in-class exercises with problems that participants can solve individually or in teams. So participants should bring their laptops. This seminar is targeted at design professionals, code officials and building owners. It is not intended for participants wanting in-depth modeling tips.

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

Operations and Maintenance of High-Performance Buildings (code 81)

8:00 am–3:00 pm, Javits Center, Room: 1C04

A high-performance building “consistently delivers a highly productive environment without wasting resources” (*ASHRAE Guideline 32: Sustainable High-Performance Operations and Maintenance*). Operating and maintaining high-performance buildings often requires different actions than a typical commercial or institutional building. After defining what a high-performance building is, this course will provide practical insights about operations and maintenance practices for both typical and high-performance buildings. This seminar includes an interactive group project to reinforce concepts such as how to identify and define energy and maintenance management metrics, and how to make the business case for changes to an existing building and its systems.

Instructors: Angela Lewis, Ph.D., P.E., Member ASHRAE, LEED® AP; and Laurie Gilmer, P.E., Member ASHRAE, LEED® AP

Introduction to Building Enclosure Commissioning (code 82)

(Co-sponsored by Building Enclosure Commissioning Collaborative)



8:00 am–3:00 pm, Javits Center, Room: 1B01

This seminar introduces the Building Enclosure Commissioning (BECx) process by outlining key quality-based activities that achieve a successful building enclosure. The seminar will include overviews on such design phase BECx activities as developing the Owner’s Project Requirements, the BECx plan, and critical building science and architectural issues to address in the design review and specifications, and construction phase BECx activities such as

construction observation and performance testing. The seminar will aid in understanding how BECx contributes towards commissioning goals and requirements and LEED®.

Instructors: Fiona Aldous, P.E., Member ASHRAE; Jay Enck, P.E., Member ASHRAE, HBDP, CPMP, BEAP, LEED® AP; and William Nash, P.E., Member ASHRAE

HALF-DAY SHORT COURSES

Registration fees: \$159 per course; \$119 for ASHRAE members
Completion of each course earns 3 PDHs/AIA LUs or .3 CEUs
(*check with your state for their continuing education credit requirements*)

SATURDAY, JANUARY 18, 2014

Electric Rates, Rules and Regulations (code 62)



12:00 pm–3:00 pm, New York Hilton, Room: Sutton North, 2nd floor

Electric rates or tariffs are constantly changing to reflect a utility’s generation and sales dynamics. These changes are usually intended to encourage end-users to use power in ways that better utilize the utility’s systems, highlight the utility’s environmental stewardship or otherwise improve the utility’s profitability and social standing within its regulated territory. This course addresses the philosophies that go into these rates and how the rates can be used to the end-user’s benefit. The course also describes how end-users can influence the utility to introduce new tariffs or add riders to existing tariffs when the end-user has opportunities that might be advantageous to the utility.

Instructor: Frank Pucciano, P.E., Member ASHRAE

SUNDAY, JANUARY 19, 2014

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

2:00 pm–5:00 pm, Javits Center, Room: 1C03

Air-to-air energy recovery provides one of the most cost-effective and efficient ways to recycle waste energy and create superior indoor environments. This course reviews real-world examples of where and how air-to-air energy recovery technologies are integrated into some of the most commonly used commercially available systems. Particular configurations that are often used in high-performance buildings and how they can best be used to meet strict goals for IEQ and energy efficiency and thermal comfort will be examined with respect to established performance metrics, peak performance results and annual energy savings.

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

Laboratory Design: The Basics and Beyond (code 64)

2:00 pm–5:00 pm, Javits Center, Room: 1C01

A comprehensive overview of HVAC design for laboratories is examined in this course. The course focuses on the essential elements of the design process that are unique to laboratory HVAC systems. Topics include: planning steps; determining exhaust/supply requirements; load calculation; pressure mapping; evaluating system options; layout of ducts and rooms; sizing primary air systems; designing exhaust stacks; sustainability in laboratories and control strategies. Example problems and case studies will also be presented.

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

Mathematical Optimization Techniques and Applications to HVAC&R Systems and Components (code 65)

2:00 pm–5:00 pm, Javits Center, Room: 1C04

Improved HVAC&R system designs can be obtained when a rigorous approach to optimization is employed. This course describes proven optimization techniques and introduces the concept of systematic optimization via real-world examples that show striking gains in lower manufacturing costs and/or higher performance of the resulting designs. Excel-based examples focus on duct and chilled water system designs and aim to minimize lifecycle cost while meeting performance requirements. The course further discusses optimization of individual components such as heat exchangers as well as optimization of a system (fan-coil units, air-conditioners, etc.).

Instructors: Reinhard Radermacher, Ph.D., P.E., Fellow ASHRAE; and Vikrant Aute, Ph.D., Member ASHRAE

MONDAY, JANUARY 20, 2014

Combined Heat and Power: Design through Operations (code 66)

8:30 am–11:30 am, Javits Center, Room: 1C01

The successful implementation and operation of a cogeneration plant is the focus of this course. The course progresses from design through construction and operations, and concludes with three case studies. The design section includes key issues that affect equipment sizes and selections, as well as the effects of those selections on plant performance and heat recovery. The construction section provides an overview of the key steps in a project's construction phase that differ from more typical central plant or general construction projects. The operations section shows the methods that should be implemented to prolong equipment life and promote operational efficiency. Each case study provides background information for the campus, and the corresponding results of the combined heat and power plant installation.

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

High-Performance Building Design: Applications and Future Trends (code 67)

8:30 am–11:30 am, Javits Center, Room: 1C03

This course presents applications of new technologies and design concepts to achieve the goal of high-performance buildings, including net-zero or nearly net-zero energy buildings. The course discusses exactly what a high-performance building is from the perspective of various stakeholders. High-performance is more than just energy efficiency, and this course addresses issues and methods for providing high-performance in areas beyond energy efficiency, such as indoor environmental quality. The course describes future trends toward high-performance buildings across the globe, and quickly summarizes how ASHRAE Standards (existing and those in development) address these topics.

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

IAQ Best Practices for Design, Construction and Commissioning (code 68)

8:30 am–11:30 am, Javits Center, Room: 1C04

What are the critical factors that can jeopardize indoor air quality (IAQ) in your next building or building project? Knowing the key components of IAQ will help you to manage, organize, direct,

design, or commission your next project. In addition to identifying key issues, this course points out what parts of the project process are especially vulnerable to risk. There are also decisions made in the project process related to building envelope, building HVAC, and building operations and maintenance that affect the long-term health of the building and its occupants. This course is based upon ASHRAE's IAQ Guide.

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

Commissioning for High-Performance Buildings (code 69)

2:45 pm–5:45 pm, Javits Center, Room: 1C01

This course presents the defining characteristics of the building commissioning process as expressed in ASHRAE Guideline 0. ASHRAE Guideline 0 has been well received by the North American design community and has spurred the development of numerous supporting guidelines and standards for the commissioning process. The course will also explore the implications of employing the ASHRAE commissioning process for high-performance buildings. Particular emphasis will be placed on the value of developing a strong Owner's Project Requirements document that can successfully guide verifications of success in the design, construction and operation phases for buildings with high expectations for performance.

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

Designing High-Performance Healthcare Facilities (code 70)



2:45 pm–5:45 pm, Javits Center, Room: 1C03

This advanced course provides an in-depth discussion of system design, controls sequences and psychrometrics to meet the aggressive performance, maintenance, reliability, energy and sustainability goals of high-performance healthcare facilities. The course covers the relationship of infection control and HVAC design, detailed definitions of the key elements of high performance in healthcare, control sequences and setpoints, and energy conservation strategies and relationship to temperature/relative humidity requirements.

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

Exceeding Standard 90.1-2013 to Meet LEED® Requirements (code 71)



2:45 pm–5:45 pm, Javits Center, Room: 1C04

This course explores how to obtain significant energy savings and obtain LEED® credits by following the new, more stringent requirements of Standard 90.1-2013, and using Appendix G rules and procedures. Appendix G is especially applicable to LEED® credits and to US energy tax credits. Standards 90.1-2010 and 90.1-2013 together produce almost 50% energy savings from the 2004 version. So, by substantially surpassing Standard 2013 requirements, buildings should achieve well over 50% energy savings. This course uses eQUEST examples, including live demos, to present an overview of applying key 90.1-2013 requirements and Appendix G rules. This course is targeted at design professionals and building owners.

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

TUESDAY, JANUARY 21, 2014

Fundamentals and Applications of Standard 55 (code 74)



1:00 pm–4:00 pm, Javits Center, Room: 1C04

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

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

Design of Commercial Ground Source Heat Pumps (code 75)



1:00 pm–4:00 pm, Javits Center, Room: 1B01

This course describes the best design practices of ground source heat pump systems to achieve maximum customer benefit. The course examines the economic analysis of ground source vs. more traditional systems and what is necessary to design an effective and efficient ground source system. The course covers energy analysis, equipment selection, drilling technologies, testing requirements, hydronic system design and system controls. Participants will learn all that is necessary for the design and installation of a successful ground source heat pump system.

Instructor: Kirk Mescher, P.E., Member ASHRAE, LEED® AP

Energy Efficiency in Data Centers (code 76)

1:00 pm–4:00 pm, Javits Center, Room: 1B04

Many opportunities exist to save energy in data centers, which are using an increasing amount of the total energy consumed by commercial facilities. The downside of this increased energy consumption is the resulting significant increases in the power required and the heat dissipated by the computing equipment. This course examines the best practices for data center energy efficiency. It focuses on the highlights from ASHRAE's Datacom

Series of publications and whitepapers. The course provides a detailed discussion of the many variables, drivers, methods and processes that facilitate energy efficient data center design and operations, as well as how to plan for future data center needs.

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

WEDNESDAY, JANUARY 22, 2014

Application of Standard 62.1-2013: Multiple Spaces Equations and Spreadsheets (code 78)



9:00 am–12:00 pm, Javits Center, Room: 1C04

Applying Standard 62.1-2013 to multiple spaces can be challenging even for advanced HVAC practitioners. This new course covers the new Appendix A method and focuses on using the spreadsheet from the User's Manual. The subject material includes both constant volume and VAV applications, and certain cases are examined where secondary recirculation applies. The course intent is to develop proficiency in using the spreadsheet tool for improving design solutions that will comply with the 2013 Standard. A copy of the spreadsheet will be provided and attendees are strongly encouraged to bring their laptops to learn the spreadsheet's power and the effect on total outdoor air required when changing different design parameters.

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

Troubleshooting Humidity Control Problems (code 79)

1:00 pm–4:00 pm, Javits Center, Room: 1C04

This course puts attendees on the fast track to understanding the effects of successful humidity control. It includes an in-depth discussion of moisture load calculations and how humidity control can be added to HVAC designs for seven different types of commercial buildings. The course also covers the effects of different humidity levels on thermal comfort, corrosion, mold growth and airborne microorganisms—information that helps the owner and designer define the optimal humidity control level for each application.

Instructor: Lew Harriman, Fellow ASHRAE

notes

WHAT IS A TECHNICAL COMMITTEE?

The technical expertise of ASHRAE is concentrated in its **Technical Committees (TCs)**, **Task Groups (TGs)**, **Technical Resource Groups (TRGs)** and **Multidisciplinary Task Group (MTGs)**. These groups are responsible in various degrees for:

- preparing the text of ASHRAE Handbook chapters
- originating, coordinating, and supervising Society-sponsored research projects
- presenting programs at ASHRAE meetings
- reviewing technical papers
- evaluating the need for standards
- and advising the Society on all aspects of the technology it embraces

ASHRAE TCs consist of people who have a recognized proficiency in a specific field of interest. TGs, similar to TCs, are formed when a subject of current interest is not covered in the scope of an existing TC or when the subject encompasses the scope of more than one TC. A TG is usually the first step towards becoming a TC when the TG's scope is not covered under a TC. TRGs are similar to TCs except that their responsibilities are limited to preparing, reviewing, or revising technical material. They do not have responsibility for programs, research, or standards. MTGs are different from TCs, TGs, and TRGs. A MTG is formed when the Society has determined a need for limited activity in a broad field of interest that encompasses the expertise of TCs from two or more sections and/or from non-TC groups such as Standing Standard Project Committees (SSPCs) or outside organizations. The functions of a MTG may include Handbook, Program, Publications, Research and Standards to various degrees, but the customary function of the MTG will be to coordinate those activities within the TCs and other groups, and organizations represented on the MTG.

APPLYING FOR MEMBERSHIP ON A TECHNICAL COMMITTEE

ASHRAE welcomes new members to its technical committees.

To be considered for technical committee membership, you must:

- Notify ASHRAE staff at TCStaff@ashrae.net of your interest in a particular TC, TG, TRG, or MTG.
- “Manage Your Membership” link from the ASHRAE Web site

Please note:

If you do not have an ASHRAE ID, are or not applying for ASHRAE membership, and are applying for a position that requires an ASHRAE bio to be on file, please go to www.ashrae.org and click on the Log In tab at the top of the page. Next click on need a login? to request an ID and PIN. You may also use that link if you already have an ASHRAE ID as a non-member, but you do not have a record of what that number is.

You will immediately be assigned as a Provisional Corresponding Member. The acceptance of provisional corresponding membership implies participation in committee activities through correspondence or in-person involvement. Provisional corresponding members serve 2 year terms. Although provisional corresponding members are not voting members, at the end of your term and based on participation in the committee, you may be considered for future voting membership.

Notification of acceptance to a TC is emailed upon your appointment.

ATTENDING TECHNICAL COMMITTEE MEETINGS

During the Annual and Winter Conference

The ASHRAE Technical Committees, Task Groups and Technical Resource Groups 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 chair at the request of a member. You are encouraged to attend any of these meetings in which you have a technical interest. TC chairs are reminded prior to each meeting to make a special effort to welcome visitors (potential members), particularly international members, to TC meetings – A TC can never have too many willing and able volunteers.

ASHRAE WINTER CONFERENCE TECHNICAL PROGRAM

New York – January 2014

Earn Professional Development Hour (PDH) credits by attending sessions listed in the Technical Program. Each hour attended in a session equals one PDH. For forums and other one-hour sessions, you must be present for the entire 50-minute program to earn a PDH. Sign-in sheets will be available in all session rooms for attendees to complete. New York State PDHs, AIA LUs and LEED AP credits are awarded for select sessions. Also, certain sessions may be acceptable for ASHRAE certification renewal. Send questions to certification@ashrae.org. Your badge will be scanned as you enter the session and a summary of sessions attended will be emailed to you upon conclusion of the conference. Please keep track of the sessions that you attend at the conference.

Technical sessions are in the New York Hilton.

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

ASHRAE'S CONFERENCES AND EXPOSITIONS COMMITTEE WELCOMES YOU TO THE 2014 WINTER CONFERENCE

Six types of sessions are presented:

Technical Paper Sessions. These sessions present papers on current applications or procedures, as well as papers resulting from research on fundamental concepts and basic theory. Papers presented in these sessions have successfully completed a rigorous peer review. You are invited to comment on these papers. Forms for written comment are available at each session, and if received by February 10, 2014, comments will be sent to respective authors for reply and publication in ASHRAE Transactions. PowerPoint presentations with audio descriptions of the presentations are posted online in the Virtual Conference. Preprints of papers and the ASHRAE Papers CD are available for purchase in the ASHRAE Bookstore.

Conference Paper Sessions. These sessions present papers on current applications or procedures, as well as papers reporting on research in process. These papers differ from technical papers in that they are shorter in length and undergo a much less stringent peer review. PowerPoint presentations with audio descriptions of the presentations are posted online in the Virtual Conference. Preprints of conference papers and the ASHRAE Papers 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, seminar PowerPoint presentations with audio descriptions of the presentations are posted online in the Virtual Conference. For a permanent record of the seminar presentations, the Seminar DVD will be available. Orders can be taken in the ASHRAE Bookstore.

Workshops. Workshops enable technical committees and other ASHRAE committees to provide a series of short presentations on a topic requiring specific expertise. These short presentations are provided with an increased emphasis on audience participation

and training in a specific set of skills. PowerPoint presentations with audio descriptions of the presentations are posted online in the Virtual Conference.

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.

Poster Session. Technical papers are presented in a poster format during this session. Posters are typically displayed throughout a day and there is a designated time when the authors will be present with the posters to answer questions. Preprints of papers and the ASHRAE Papers CD are available for purchase in the ASHRAE Bookstore.

AHR Expo Session. This session is presented only at the Society’s winter conferences. The session itself is scheduled at the Javits Convention Center, the site of the ASHRAE co-sponsored AHR Expo. This session is open to the public – no badge required. It is conducted as a “seminar” with presentations. Papers are not prepared for the AHR Expo Session.

VIRTUAL CONFERENCE

Free for Paid Conference Registrants

ASHRAE is offering 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 New York 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 New York. If you do not have your password and link go to www.ashrae.org/newyork virtual 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, technical paper and conference paper presentations
- Access to posters presented in the poster session
- Ability to post questions or answers for selected sessions through Wednesday, Feb. 5. Presentations available online for 18 months.

A full slate of technical programs will be posted beginning Monday, Jan. 20, of the sessions that were presented the previous day, with additional content posted through Wednesday, Jan. 22.

On-site registration is available for those who would like to purchase the Virtual Conference. To purchase you can do so online or go to ASHRAE Registration, Hilton, Rhinelander Gallery, 2nd floor, \$249 ASHRAE member; \$445 non member. If you register on site, your password will be emailed to you within 24 hours of your registration.



ASHRAE Papers CD: 2014 Winter Conference (All Papers on CD)

Technical Paper, Conference Paper, and Poster Session papers as presented at this Conference \$105 (includes five FREE hard copies of preprint papers).

Available at the Conference Bookstore



Conference Seminars DVD

62 Seminars (PowerPoint files synced with speakers' audio)

\$119 (ships April 2014)



Conference Preprints (individual papers, in print)

Technical Paper, Conference Paper, and Poster Session papers as presented at this Conference \$6 each

Available at the Conference Bookstore



ASHRAE Transactions (Print Volume)

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

\$79 (ships May 2014)



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



GBCI LEED AP CE Credits

Packages

1. ASHRAE Papers CD and *ASHRAE Transactions* (See descriptions at left.)

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

\$149 – Available at the Conference Bookstore

2. ASHRAE Papers CD and Seminars DVD

\$175 – Purchase in the Conference Bookstore

3. Complete Winter Conference Content Package (ASHRAE Papers CD, Seminars DVD, and *ASHRAE Transactions*)

\$199 – Purchase in the Conference Bookstore

All prices are special conference-only prices.

Sunday, January 19

8:00 AM-9:00 AM

WORKSHOP 1 (INTERMEDIATE)

Chemical Laboratories Classification to Improve Safety and Energy Efficiency

Track: Indoor Environmental Health/Indoor Environmental Quality
Room: Regent

Sponsor: 09.10 Laboratory Systems

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

ASHRAE's technical committee TC-9.10 on laboratory systems has long desired to simplify lab design by establishing a classification that tells designers what features and performance levels are required. They point to the very successful classification of biology labs and want something just as useful for chemistry labs. These people are engineers and recognize that they cannot do this alone. The involvement of EH&S experts in a joint effort with ASHRAE will permit to develop a lab classification. This classification will increase the safety of the lab and will permit to save energy at the same time.

1. Lab Classification and Potential Impacts on Lab Design

Adam R. Bare, P.E., Member, Newcomb & Boyd, Atlanta, GA

2. The Feasibility of Lab Classification Based on Chemicals Types and Risks

Ralph Stuart, Cornell University, Ithaca, NY



8:00 AM-9:00 AM

WORKSHOP 3 (INTERMEDIATE)

Implementing Benchmarking and Energy Use Disclosure Policy

Track: Building Information Systems
Room: Beekman

Sponsor: Grassroots Government Activities Committee

Chair: Ashish Rakheja, P.E., Member, Regional Managing Director, AECOM India Pvt. Ltd., New Delhi, India

Energy use disclosure is the "hottest" public policy issue relative to energy efficiency. Many communities have adopted disclosure statutes and ordinances for buildings that abide by benchmarking and disclosure guidelines. ASHRAE currently does not have a position on energy use disclosure. With the launch of bEQ as a rating and disclosure tool, is it in ASHRAE's interest to engage with policymakers to ensure that full consideration is given to the implementation of bEQ as a method of compliance with benchmarking and disclosure policies? This session includes a panel discussion to debate the options for benchmarking and disclosure guidelines.

1. ASHRAE's Role in Adopting Energy Use Disclosure Policy

Jeff Gatlin, Thompson Engineers, Memphis, TN

2. The State's Role in Implementing Energy Use Disclosure Policy

David Terry, National Association of State Energy Officials, Arlington, VA

3. Implementing Benchmarking and Disclosure Use Policy

Cliff Majersik, Institute for Market Transformation, Washington, DC



8:00 AM-9:00 AM

WORKSHOP 2 (ADVANCED)

Engineering Ethics: A Case Study Analysis

Track: Fundamentals and Applications
Room: Sutton South

Sponsor: 01.07 Business, Management & General Legal Education

Chair: Jennifer E. Leach, P.E., Member, Cummins-Wagner Co, Inc., Annapolis Junction, MD

8:00 AM-9:00 AM

WORKSHOP 4 (INTERMEDIATE)

Increasing Role of Advanced Equipment of Control and Monitoring in the Water Treatment Industry

Track: *Building Information Systems*

Room: *Rendezvous Trianon*

Sponsor: *03.06 Water Treatment, 08.06 Cooling Towers and Evaporative Condensers*

Chair: *William E. Pearson II, Member, Southeastern Labs, Raleigh, NC*

Amazing progress has been made in remote monitoring, control, and use of technology in the water treatment industry. In this session, attendees learn how to use these tools to advance and optimize water treatment programs monitoring from your computer, tablet, or phone including iCloud applications. It's really COOL stuff.

1. The Emerging Role of Technology in Cooling Water Treatment

Todd Cornwell, Member, Garrett Calahan Company, Raleigh, NC

2. Communicating with Other BACnet or Other Building Management System and Cloud Storage

Henry A. Becker, Member, H-O-H Water Technology, Inc, Palatine, IL

3. Remote Monitoring of Water Treatment Equipment in Today's Steam Plant

Dan Wiemar, Member, Chem-Aqua, Tallahassee, FL



8:00 AM-9:00 AM

WORKSHOP 7 (BASIC)

Panel Discussion: Why Aren't You Using Thermal Energy Storage? Dispelling the Myths and Discussing the Realities of TES Integration and Cost Savings

Track: *Hydronic System Design*

Room: *Sutton North*

Sponsor: *06.09 Thermal Storage*

Chair: *Lucas B. Hyman, P.E., Member, Goss Engineering, Inc., Corona, CA*

Even though thermal storage has literally been in use for thousands of years, many owners and engineers are unfamiliar with the many benefits of thermal storage. This seminar starts with a brief 15 minute presentation on the basics and benefits of thermal storage followed by a 45-minute questions-and-answers session with a 4-person panel comprised of an owner's representative, utility company representative, a thermal storage vendor, and a thermal storage engineer.

1. Thermal Storage Basics

Lucas B. Hyman, P.E., Member, Goss Engineering, Inc., Corona, CA

2. Panel

John Nix¹, John S. Andrepont, Life Member², Mark MacCracken, P.E., Member³ and Edward (Ted) Borer⁴, (1)FPL, Miami, FL, (2)The Cool Solutions Company, Lisle, IL, (3)CALMAC Manufacturing Corp, Fair Lawn, NJ, (4)Princeton University, Princeton, NJ

8:00 AM-9:00 AM

WORKSHOP 5 (ADVANCED)

Is ASHRAE Tall Enough for Tall Buildings?

Track: *Tall Buildings: Performance Meets Policy*

Room: *Trianon*

Sponsor: *09.12 Tall Buildings*

Chair: *Peter Simmonds, Ph.D., Fellow ASHRAE, Stantec, Sherman Oaks, CA*

This presentation evokes discussion on ASHRAE's role in the design and development of tall, mega tall and super tall buildings. The present ASHRAE definition of a Tall Building is a building that is taller than 300ft (100m). The scope of ASHRAE's subcommittee for Tall Buildings is being revised to include Mega Tall, 300m and Super Tall 600m buildings. With the increase of a buildings height come engineering challenges which must be resolved. Some of the world's leading expert and designers of Tall Buildings around the world discuss present day trends with the audience.

8:00 AM-9:00 AM

WORKSHOP 6 (INTERMEDIATE)

Linking Tall Buildings' Energy Use to Tenant Contribution to Economy

Track: *Tall Buildings: Performance Meets Policy*

Room: *Sutton Center*

Chair: *Steve Baumgartner, P.E., Associate Member, Buro Happold, New York, NY*

The session introduces two new metrics in commercial buildings and presents the results of a study that correlates the world's largest energy benchmarking database with the world's largest commercial tenant database. The presentation reveals trends between buildings' energy use and the economic contribution that the buildings' tenants have on the local New York City economy. Discussion follows on the implications of these metrics in urban planning, energy policy, and economic stability.

1. Linking Tall Buildings' Energy Use to Tenant Contribution to Economy

Steve Baumgartner, P.E., Associate Member¹, Jim Coleman, Ph.D.² and Amelia Aboff³, (1)Buro Happold, New York, NY, (2)Happold Consulting, London, England, (3)Happold Consulting, New York, NY

8:00 AM-9:00 AM

WORKSHOP 8 (INTERMEDIATE)

Performance-based Codes and Standards: Catalyst for Energy Efficiency Retrofits in the 21st Century?

Track: *Commissioning, Operation and Maintenance*

Room: *Mercury*

Sponsor: *MTG.ET Energy Targets*

Chair: *Don Brandt, Member, Trane Co., Phoenix, AZ*

Historically, performance-based pathways for complying with building code have been under-utilized, referring in particular to the Energy Cost Budget (ECB) method in ASHRAE 90.1. Market uptake has variously been affected by reluctance of building designers and code officials, the skill/time/expense required to develop an energy simulation model, and even the availability of too many performance approaches (Rosenberg et al, 2013). In this latter case, the popular green building program LEED draws upon the 90.1 Appendix G Performance Rating Method (PRM), several jurisdictional codes and/or ordinances reference LEED or various versions of the PRM, whereas still others use modified versions of the ECB. To add to the mix, an exciting new code intended energy standard for existing commercial buildings – Standard 100 – is on the horizon. Without greater alignment, it is possible that availability of choice will inadvertently be a market barrier to greater use of performance-based pathways.

1. Are Performance-Based Standards a Faster Path to Greater Energy Efficiency?

William P. Bahnfleth, Ph.D., P.E., Presidential Fellow ASHRAE, The Pennsylvania State University, University Park, PA

2. ASHRAE Standard 100: Performance-Based Energy Standard for Existing Buildings

Richard D. Hermans, P.E., Member, McQuay International, Minneapolis, MN



9:00 AM - 9:45 AM

NETWORKING COFFEE BREAK

[3rd Floor Promenade]

Grab some coffee and network with your fellow ASHRAE conference attendees after the opening sessions. This is a great chance to discuss the morning's interactive Workshops and form connections to make the most of your time in New York.

9:45 AM-10:45 AM

TECHNICAL PAPER SESSION 1 (INTERMEDIATE)

Hydraulic Modeling as a Tool to Enable Design Resiliency and Quantify Pump Energy Savings for Data Center Chilled Water Systems

Track: *Fundamentals and Applications*

Room: *Rendezvous Trianon*

Sponsor: *09.09 Mission Critical Facilities, Technology Spaces and Electronic Equipment*

Chair: *Nick Gangemi, Member, Facility Gateway Construction, Madison, WI*



This session looks at hydraulic modeling as a tool to examine failure modes of a central plant chilled water system, and also to predict energy savings from part-load pumping strategies taking advantage of redundant pumps and other equipment. The program is capable of solving for balanced flows and pressures throughout the system. It allows individual pipelines to be easily shut off, simulating failure modes, and also allows pump speeds to be reduced, allowing for simulation of VFD operation. The procedures and results are demonstrated for a theoretical data center with a 5 MW IT Load.

1. Hydraulic Modeling as a Tool to Enable Design Resiliency for Data Center Chilled Water Systems (NY-14-001)

Michelle Contri, P.E., Member and Thomas A. Davidson, P.E., Member, DLB Associates, Eatontown, NJ

2. Hydraulic Modeling as a Tool to Quantify Pump Energy Savings in Data Center Chilled Water Systems (NY-14-002)

Thomas A. Davidson, P.E., Member and Michelle Contri, P.E., Member, DLB Associates, Eatontown, NJ

9:45 AM-10:45 AM

TECHNICAL PAPER SESSION 2 (INTERMEDIATE)

Two-phase Flow Analysis on Refrigeration Systems

Track: *Systems and Equipment*

Room: *Trianon*

Chair: *Chao-Hsin Lin, Ph.D., Member, The Boeing Company, Seattle, WA*



It is essential to understand the multiphase phenomena associated with refrigeration systems. In this session, the related topics include the effect of lubricant on the distribution of the gas-liquid two-phase system was investigated to study the detrimental effect of moisture contamination on the performance of the system, in-depth analysis of pressure difference on the performance of a two-phase flow in refrigeration systems, and a CFD simulation of the refrigerant flow in a capillary tube validated by measured data as well as a separate numerical investigation.

1. Effect of Lubricant on the Distribution of Water between Vapor and Liquid Phases of Refrigerants (RP-1495) (NY-14-003)

John Senediak, Member, Intertek, Columbus, OH

2. Investigation of Two-Phase Flow in Refrigeration Systems (NY-14-004)

Syed Zahid Hussain Rizvi, Johnson Controls Inc - IR Industrial Refrigeration, Dubai, United Arab Emirates

3. Two-Phase VOF Model for the Refrigerant Flow through Adiabatic Capillary Tube (NY-14-005)

Mohd. Kaleem Khan, Member, Indian Institute of Technology Patna, Patliputra Colony, India

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 1 (INTERMEDIATE)

Boilers and Cooling Towers: Energy and Water Conservation Through Better System Design and Innovative Retrofits

Track: *Hydronic System Design*

Room: *Beekman*

Chair: *Leon Shapiro, J.D., Member, Green Building Group, Oak Park, CA*



Boilers and cooling towers are two of the most water-consuming systems in many large buildings. This session explores how significant energy and water savings can be achieved through improved condensing boiler system design, retrofit with advance load monitoring boiler controllers, and reuse of cooling tower blow-down for landscape irrigation. Each paper discusses design principals and/or results of laboratory/field testing to provide guidance on how engineers and building operators can more effectively design and operate their boilers and cooling towers.

1. Field and Laboratory Evaluation of Advanced Load Monitoring Boiler Controllers (NY-14-C001)

Paul Glanville, P.E., Associate Member¹, Patricia F. Rowley¹ and David J. Schroeder, Member², (1)Gas Technology Institute, Des Plaines, IL, (2) Northern Illinois University, Dekalb, IL

2. Landscape Irrigation Using Cooling Water Blowdown: An Innovative and Sustainable Approach (NY-14-C002)

Leon Shapiro, J.D., Member¹ and Philip Vella, Ph.D., Associate Member², (1)Green Building Group, Oak Park, CA, (2)VRTX Technologies, Schertz, TX

3. Principals of Condensing Boiler System Design (NY-14-C003)

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

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 2 (INTERMEDIATE)

Filter Media Performance

Track: *Indoor Environmental Health/*

Indoor Environmental Quality

Room: *Sutton North*

Sponsor: *02.03 Gaseous Air Contaminants and Gas Contaminant Removal Equipment*

Chair: *Henry A. Becker, Member, H-O-H Water Technology, Inc, Palatine, IL*



This session examines the performance of ozonation air filters, ASHRAE Standard 145's application to gas-phase air cleaners and two promising air purification technologies for indoor volatile organic compound removal.

1. Ozonation Air Purification Technology in HVAC Applications (NY-14-C004)

Lexuan Zhong, Ph.D., Student Member and Fariborz Haghighat, Ph.D., P.E., Fellow ASHRAE, Concordia University, Montreal, QC, Canada

2. ASHRAE 145.2 Efficiency and Capacity Test Results for Five Gas-Phase Air Cleaners (NY-14-C005)

M. Kathleen Owen, Member, Roger Pope and James T. Hanley, Member, Research Triangle Institute, Research Triangle Park, NC

3. Testing and Evaluation of Filter Media Performance: Correlation Between High and Low Challenge Concentration Tests for Toluene and Formaldehyde (ASHRAE 1557) (NY-14-C006)

Chuan He¹, Bing Guo¹, Jinjing Pei², Wenhao Chen, Associate Member³, KwangHoon Han, Ph.D., Member¹ and Jianshun Zhang, Ph.D., Fellow ASHRAE¹, (1)Syracuse University, Syracuse, NY, (2) Tianjin University, Tianjin, China, (3) California Department of Public Health, Richmond, CA

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 3 (INTERMEDIATE)

Maintaining Occupant Comfort Levels while Minimizing Energy Impact

Track: *International Design*

Room: *Sutton South*

Chair: *Gary C. Debes, Member, Coward Environmental Systems, Coatesville, PA*



Learn how to conserve energy in various buildings by controlling ventilations rates, monitoring energy usage and imbedding heating and cooling within the building structure. The case studies include an Animal Facility utilizing demand control ventilation while maintaining pressure relationships, A large scale, 930,000 square meters (10,000,000 square feet) University Campus utilizing demand metering for energy conservation, and a Thermally Activated Building System (TABS) embedded water based heating and cooling system in the building structure.

1. Energy Saving Strategy of Large-Scale University Facilities (NY-14-C007)

Takumi Ohashi and Yoshiyuki Shimoda, Dr.Ing., Osaka University, Suita, Japan

2. Evaluation on the Occupants' Thermal Comfort with Thermally Activated Building System in Campus Building of South Korea through Questionnaires and Field Measurements (NY-14-C008)

Jin-Hee Song, Jae-han Lim, Ph.D. and Seung-Yeong Song, Ph.D., Ewha Womans University, Seoul, South Korea

3. The First Step of Demand Control Ventilation in an Animal Facility in Japan: Design and Commissioning for Flexible Ventilation (NY-14-C009)

Masaya Ishihara, Azbil Corporation Building Systems Company, Tokyo, Japan

9:45 AM-10:45 AM

SEMINAR 1 (INTERMEDIATE)

Integration for Successful Operations: Avoid a Recipe for Disaster – Get the Right Cooks in the Kitchen!

Track: Building Information Systems

Room: Mercury

Sponsor: 01.04 Control Theory and Application

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

As a building owner, how do I ensure that the smart systems in my new facility are fully integrated when the building is turned over? Which engineers and contractors should I involve in the integration process and at what stage? Learn the best ways to express operational expectations for Facility Management and Control Systems and incorporate them into construction documents. Lessons learned from successful integration projects are presented from owners, engineers, and contractors.

1. Utilizing Smart Systems for Portfolio Performance Management: Lessons Learned

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

2. Herding Cats: Managing Scope and Responsibility in a Successful Integration Project

Robert Betz, McCarthy Building Companies, San Diego, CA



9:45 AM-10:45 AM

SEMINAR 2 (ADVANCED)

Thermodynamic Analysis for Low-GWP Refrigerants

Track: Refrigeration

Room: Regent

Sponsor: MTG.LowGWP Alternative Lower Global Warming Potential Refrigerants, 03.01; 08.11; USNT/IIR, Refrigeration Committee

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

The HVAC&R community is searching for low-GWP refrigerants in order to reduce environmental effects from refrigerants. This seminar addresses such efforts in several approaches. The evaluation results of effects of a refrigerant's fundamental thermodynamic parameters on its performance in the vapor compression cycle are presented. Then, results of complete and systematic screening of candidate refrigerants from extensive chemical compounds database are presented.

1. Thermodynamic Performance Limits of the Vapor Compression Cycle

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

2. Possibilities and Tradeoffs for Low-GWP Refrigerants

Mark McLinden, Ph.D., Member, National Institute of Standards and Technology, Boulder, CO

11:00 AM-12:30 PM

TECHNICAL PAPER SESSION 3 (INTERMEDIATE)

Modeling Considerations for PCM, DCV, Photovoltaics and Solar House Design

Track: Systems and Equipment

Room: Sutton Center

Chair: Xuanhang (Simon) Zhang, Member, APC by Schneider Electric, Billerica, MA

This session presents papers on a variety of modeling applications. These include implementing phase change materials into building practice, designing CO₂-based demand-controlled ventilation to meet Standard 62.1-2010, study of the influence parameters during forced and free convection of air between a photovoltaic panel and glass glazing of curtain wall integrated photovoltaic/thermal (BIPV/T) system, and a modeling approach for passive solar houses.

1. Applicability of Multilayered Phase-Change-Material Modeling in Building Simulation (NY-14-006)

Fabio Almeida, Ph.D., Ryerson University, Toronto, ON, Canada



2. Evaluation on the Validity of the Assumptions Underlying CO₂-based Demand-controlled Ventilation (RP-1547) (NY-14-007)

Josephine Lau, Ph.D., Associate Member, University of Nebraska – Lincoln, Omaha, NE

4. Building Integrated Photovoltaic/Thermal Façade with Forced Ventilation and Natural Convection (NY-14-008)

Getu Hailu, Ph.D.¹ and Alan Fung¹, (1)Ryerson University, Toronto, ON, Canada

5. Solar Design Days: A Tool for Passive Solar House Design (NY-14-009)

William O'Brien, Ph.D., Member¹, Ted Kesik, Ph.D., P.E., Member² and Andreas Athienitis, Ph.D., P.E., Member³, (1)Carleton University, Ottawa, ON, Canada, (2)University of Toronto, Toronto, ON, Canada, (3)Concordia University, Montreal, QC, Canada

11:00 AM-12:30 PM

CONFERENCE PAPER SESSION 4 (INTERMEDIATE)

Evaluation of Compressor Performance and Predictive Modeling for Low Global Warming Potential Refrigerants

Track: Refrigeration

Room: Regent

Chair: Dan Wiemar, Member, Chem-Aqua, Tallahassee, FL

One of the challenges facing the HVAC industry is the research and development of alternative refrigerants with compatible lubricants/additives with low GWP (Global Warming Potential). Understanding the performance or lack thereof with low GWP refrigerants and compatible lubricants will be fundamental to accurate modeling. It will also be important to understand and know the effects of a particular alternative refrigerant and the lubrication/additive such as deposits, corrosion, metal loss and increased heat and condensing pressure.

1. R134a and PAG Oil Maldistribution and Its Impact On Microchannel Heat Exchanger Performance (NY-14-C010)

Yang Zou, Huize Li and Pega Hrnjak, University of Illinois at Urbana-Champaign, Urbana, IL

2. Effects of System Materials towards the Breakdown of POE Lubricants and HFC Refrigerants (NY-14-C011)

Ngoc Dung (Rosine) Rohatgi, Ph.D., Member, Spauschus Associates Inc., Sylva, NC

3. Thermodynamic Analysis of CO₂ Transcritical Supermarket Refrigeration Systems (NY-14-C012)

Vishaldeep Sharma, Brian Fricke, Ph.D., Member and Pradeep Bansal, Ph.D., Fellow ASHRAE, Oak Ridge National Laboratory, Oak Ridge, TN

4. Comprehensive Compressor Calorimeter Testing of Lower-GWP Alternative Refrigerants for Heat Pump and Medium Temperature Refrigeration Applications (NY-14-C013)

Som S. Shrestha, Member, Vishaldeep Sharma and Omar Abdelaziz, Ph.D., Associate Member, Oak Ridge National Laboratory, Oak Ridge, TN

5. Development of Versatile Compressor Modeling Using Approximation Techniques for Alternative Refrigerants Evaluation (NY-14-C014)

Omar Abdelaziz, Ph.D., Associate Member and Som S. Shrestha, Member, Oak Ridge National Laboratory, Oak Ridge, TN

11:00 AM-12:30 PM

SEMINAR 3 (INTERMEDIATE)

Can Low Energy Buildings be Healthy for Occupants?

Track: Indoor Environmental Health/

Indoor Environmental Quality

Room: Sutton North

Sponsor: Environmental Health Committee

Chair: Lawrence Schoen, P.E., Fellow ASHRAE, Schoen Engineering Inc., Columbia, MD

This seminar presents highlights of ASHRAE's IAQ 2013 Conference, Environmental Health in Low Energy Buildings, which was held October 15–18, 2013 in Vancouver, British Columbia, Canada. Four high quality papers selected from among the hundreds submitted for this conference address topics of high interest in the design and operation of buildings that strive to be both highly sustainable while also achieving high Indoor Environmental Quality.



1. Robust Climate Design Combines Energy Efficiency with Occupant Health and Comfort

Stanley R. Kurvers, P.Eng., Delft University of Technology, Delft, Netherlands

2. Building Design and Operational Choices that Impact Indoor Exposures to Outdoor Particulate Matter Inside Residences

Brent Stephens, Ph.D., Associate Member, Illinois Institute of Technology, Chicago, IL

3. Indoor Environmental Quality, Occupants' Perception, Prevalence of SBS Symptoms and Sick Leave in a Green Mark Platinum versus a Non-Green Mark Rated Building

Pawel Wargocki, Ph.D., Member, Technical University of Denmark, Lyngby, Denmark

4. Natural Ventilation in California Offices: Estimated Health Effects and Economic Consequences

Spencer Dutton, Ph.D., Lawrence Berkeley National Laboratory, Berkeley, CA

11:00 AM-12:30 PM

SEMINAR 4 (INTERMEDIATE)

CFD for Data Center Applications Part 1 – Modeling Advancements

Track: Fundamentals and Applications

Room: Mercury

Sponsor: 09.09 Mission Critical Facilities, Technology Spaces and Electronic Equipment, 4.10, 04.10 Indoor Environmental Modeling

Chair: Nick Gangemi, Member, Facility Gateway Construction, Madison, WI

As evidenced by the number software tools available commercially today, Computational Fluid Dynamics (CFD) is widely employed in the design and management of data centers and has become a vitally important technology in the quest to make these complex and energy-intensive facilities more reliable and energy efficient. In the second part of this two-part seminar, we look at recent advancements in CFD modeling technology for data center applications.

1. Experimental Validation Of Data Center Rack Models

John Zhai, Ph.D., Member, Knud Hermansen and Saleh Al-Saadi, University of Colorado, Boulder, CO

2. An Enhanced Potential Flow Model For Data Center Applications

James VanGilder, P.E., Member, Xuanhang (Simon) Zhang, Member and Christopher M. Healey, Ph.D., Schneider Electric, Billerica, MA

3. A Hybrid CFD/Lumped-Capacitance Model For Simulating Data Center Transients

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



11:00 AM-12:30 PM

SEMINAR 5 (INTERMEDIATE)

Design to Ensure Building Performance with a Comprehensive M&V Process: A LEED Platinum Case Study

Track: Commissioning, Operation and Maintenance

Room: Rendezvous Trianon

Sponsor: 07.01 Integrated Building Design

Chair: Elyse Malherek, Associate Member, The Weidt Group, Minnetonka, MN

Can we guarantee the energy performance of a building into occupancy? Using a comprehensive measurement and verification process including commissioning and a continued design team and owner relationship can ensure long-term energy performance and thermal comfort. With two years of operational data available, this case study explores how the M&V process helps the team to evaluate the performance of the building by comparing to the design intent, verifying how design elements perform in real life, investigating new energy saving opportunities, and educating occupants on energy efficiency. This full-circle process ensures the performance of a LEED Platinum building.

1. Understanding Ongoing Building Efficiency from the Owner's Perspective

Matthew Brown, Wellmark, Des Moines, IA

2. Engineering a Building for Lifetime Efficiency

Dale Dent, P.E., The Baker Group, Des Moines, IA



3. Creating a Comprehensive M&V Process Incorporating Calibrated Energy Models

Jason Steinbock, Associate Member, The Weidt Group, Minnetonka, MN

11:00 AM-12:30 PM

SEMINAR 6 (INTERMEDIATE)

Efficient Technologies That Are Also Economically Sustainable, Part 1 of 3: District Energy (DE) and Complementary Options

Track: Hydronic System Design

Room: Beekman

Sponsor: 06.02 District Energy, TC01.10 Cogeneration Systems, and TC06.09 Thermal Storage

Chair: Blake E. Ellis, P.E., Member, Burns & McDonnell, Kansas City, MO

This is the first of a three part series highlighting the ability to implement many different technologies utilizing a district energy system that might not be available for individual buildings. This session begins with information on some of the technologies such as thermal energy storage and combined heat and power can be implemented and the benefits of combining the technologies. The session concludes with two case studies that have implemented these technologies and will focus on other benefits (such as being a power island) and implementation of other technologies such as solar thermal and biomass.

1. The Big 3 (District Energy, CHP and TES): Where 1+1+1 Can Equal 10

John S. Andrepont, Life Member, The Cool Solutions Company, Lisle, IL

2. District Energy Overview and Benefits

David W. Wade, P.E., Member, RDA Engineering, Marietta, GA

3. Case Study from Saint Paul, Minnesota: District Energy with CHP, TES and Renewable Fuel

Anders J. Rydaker, Ever-Green Energy, St. Paul, MN

4. Reliability, Energy Efficiency and Environmental Stewardship, with Market Sensitivity: Princeton University as a Case Study of District Energy with CHP, TES and Economic Dispatch

E. Ted Boer, P.E., Member, Princeton University, Princeton, NJ



11:00 AM-12:30 PM

SEMINAR 7 (ADVANCED)

The Façade Odyssey: Solutions for Design of High Performance Buildings

Track: Systems and Equipment

Room: Trianon

Sponsor: 02.08 Building Environmental Impacts and Sustainability, ASHRAE Associate Society Alliance

Chair: Kent Peterson, P.E., Presidential Fellow Life Member, P2S Engineering, Inc., Long Beach, CA

This seminar focuses on façade design as an important aspect of building, largely controlled by architects as per wishes of building owners. However, based on experience of design of several Green Buildings, it has been found that façade optimization can help reduce as much as 40% of building energy. This becomes an important aspect in developing economies wherein decisions are generally based on first cost with little importance to life cycle cost. Emerging markets like BRIC nations will add over 100 billion square feet in next two decades and better understanding of facade design will go a long way in preserving ecological balance in the world. Speakers from different parts of world present experience on the effect of various basic elements in design of envelope and its consequent effect on building operating energy, carbon emissions and air-conditioning load. The final part of presentation focuses on future façade solutions.

1. Façade Design for Natural Ventilation

Frank A. Mills, P.E., Member, Low Carbon Design Consultants, Leyland, United Kingdom

2. Double Façade, Phase Change Materials, and Green Walls

Ashish Rakheja, P.E., Member, Chief Operating Officer of Spectral, New Delhi, India

3. Latest Developments in High Performance Facades in North America

John Swift Jr., P.E., Member, Cannon Design, Boston, MA



11:00 AM-12:30 PM

SEMINAR 8 (BASIC)

The Latest Trends and Abilities of Mobile Applications for Load Calculations and Building Energy Evaluations

Track: Building Information Systems

Room: Sutton South

Sponsor: 04.01 Load Calculation Data and Procedures, 01.05

Computer Applications

Chair: Glenn Friedman, P.E., Fellow ASHRAE, Taylor Engineering, Alameda, CA



Are your HVAC load calculation and energy tools current? The latest trends and abilities of mobile applications for load calculations and building energy evaluations are explored.

1. Recent Advances in Mobile Load Calculations

Stephen Roth, P.E., Member, Carmel Software Corp., San Rafael, CA

2. Residential Load Calculations and Equipment Selection in a Mobile Environment

Charles S. Barnaby, Member, Wrightsoft Corp., Lexington, MA

3. Development of Mobile Applications for Rapid Building Retrofit Assessment at the EEB Hub

Russell Taylor, United Technologies Research Center, East Hartford, CT

1:30 PM-3:00 PM

SEMINAR 9 (INTERMEDIATE)

Emerging Technologies in the Built Environment: Geographic Information Science (GIS), 3D Printing, and Additive Manufacturing

Track: Fundamentals and Applications

Room: Mercury

Sponsor: 01.05 Computer Applications

Chair: Stephen Roth, P.E., Member, Carmel Software Corporation, San Rafael, CA



This session highlights current capabilities and recent advances in both geographic information systems, 3D printing, and additive manufacturing. The GIS portion will focus on advanced research, development, and applications of geographic information and analysis systems to support the nation's energy, environment, and security programs, from local to global scales. Likewise, the next generation of manufacturing portion showcases 3D printing and additive manufacturing results and simulation methods for revolutionizing the way buildings and products are designed and built to enable energy efficient mass production.

1. Geographic Information Science (GIS) and the Built Environment

Budhendra Bhaduri, Ph.D., Oak Ridge National Laboratory, Oak Ridge, TN

2. 3D Printing for Commercial Building Design

Mark Buckner, Ph.D., Oak Ridge National Laboratory, Oak Ridge, TN

3. New Frontiers in Additive Manufacturing

Lonnie Love, Ph.D., Oak Ridge National Laboratory, Oak Ridge, TN

1:30 PM-3:00 PM

SEMINAR 10 (BASIC)

Engineering Our Cities to Meet and Beat the Challenges of Climate Change

Track: International Design

Room: Sutton South

Sponsor: CIBSE ASHRAE Liaison, 02.08 Building Environmental Impacts and Sustainability

Chair: Tim Dwyer, Fellow ASHRAE, Bartlett School of Graduate Studies, University College London, London, United Kingdom



The engineering, landscaping, and building communities are in an ideal position to reduce the impact of cities on climate as well as creating and operating safe and effective cities in future climates that are likely to be 2 degrees C warmer than today. This session considers how climate change will impact the HVAC&R professional, how systems are already failing to meet demands of a warming climate, and the impact that increasingly challenging environment has on air conditioning systems. It concludes by considering the status of cities and why the 5th international law is needed to halt core causes of climate change.

1. Preparing Our Cities for a Changing Climate

Hywel Davies, Ph.D., Member, Chartered Institution of Building Services Engineers, London, England

2. Air Conditioning Failures: Now and Future

David Arnold, Ph.D., Fellow Life Member, London South Bank University, London, United Kingdom

3. The Missing 5th International Law: Time to Protect the Earth and Our Cities

George Adams, CIBSE President, FCIBSE, SPIE Matthew Hall, London, England

1:30 PM-3:00 PM

SEMINAR 11 (INTERMEDIATE)

Heat Exchanger Designs for Lower GWP Refrigerants

Track: Refrigeration

Room: Regent

Sponsor: 08.04 Air-to-Refrigerant Heat Transfer Equipment

Chair: Edward A. Vineyard, P.E., Member, Oak Ridge National Laboratory, Oak Ridge, TN



The use of refrigerants with low global warming potential (GWP) may require changes in heat exchanger designs which include internal enhancements or reduced internal volume. This seminar presents information on modeling and test results with low GWP refrigerants that will enable equipment designers to plan for any impending changes that will be required to accommodate low GWP refrigerants.

1. Air-to-Refrigerant Heat Exchangers

Brian Fricke, Ph.D., Member, Oak Ridge National Laboratory, Oak Ridge, TN

2. Heat Exchanger Design Considerations for Low GWP Refrigerants

Chad Bowers, Ph.D., Associate Member, Creative Thermal Solutions, Urbana, IL

3. System Performance with Heat Exchanger Designs using Refrigerants R-152a and R-1234yf

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

1:30 PM-3:00 PM

SEMINAR 12 (INTERMEDIATE)

Hydronic System Acoustics

Track: Hydronic System Design

Room: Beekman

Sponsor: 02.06 Sound and Vibration Control

Chair: Erik Miller-Klein, P.E., Associate Member, SSA Acoustics, LLP, Seattle, WA



Understanding the acoustics characteristics of HVAC equipment and designing in the proper sound levels is important to building occupants' comfort. This session covers the sound characteristics of various chillers, including fixed and more efficient variable speed designs. An in-depth discussion is presented for a new AHRI standard 1280P, which provides the sound power rating method for water-cooled chillers. The general operation principles for active chilled beams and the primary sound generation mechanism are introduced. An overview of how the acoustic performance is measured and cataloged is provided. Selection and performance guidelines are also presented.

1. Acoustics Characteristics of Chillers

Jack Wang, Member, Ingersol Rand, La Crosse, WI

2. New AHRI 1280 Sound Power Rating Standard of Water-Cooled Chillers

Patrick C. Marks, P.E., Member, Johnson Controls, York, PA

3. Chilled Beams: Inducing Acoustic Performance

Patrick Oliver, P.Eng., Member, E.H. Price, Ltd., Winnipeg, MB, Canada

1:30 PM-3:00 PM

SEMINAR 13 (INTERMEDIATE)

IAQ in Low-Energy Homes: Avoiding Collateral Damage

Track: Indoor Environmental Health/Indoor Environmental Quality

Room: Sutton North

Sponsor: Environmental Health Committee

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



Great progress has been made in reducing residential energy consumption, with the latest buzzword being net-zero. Whether a home is net-zero or very low energy, it is critically important that energy efficiency measures do not compromise the indoor environment. Homes, and buildings in general, exist for the occupants, not to win energy efficiency competitions, and there is a perceived, and in some cases real, tension between the goals of energy efficiency and indoor air quality. As we move towards low-energy homes, we need to consider IAQ by providing low-energy homes that support and ideally improve the health and comfort of the occupants.

1. Field Study of Airtightness, Ventilation and IAQ in 24 High Performance Green California Homes

Brennan Less, Lawrence Berkeley National Laboratory, Berkeley, CA

2. VOC and HCHO Measurements in New Homes

Brett Singer, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

3. The Realities of Operation and Occupancy in Net-Zero Energy Homes: Two Case Studies

Kurt Roth, Ph.D., Member, Fraunhofer Center for Sustainable Energy Systems, Cambridge, MA

4. IAQ Specs in a Net-Zero Energy Research Home: How Well Did They Work?

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

1:30 PM-3:00 PM

SEMINAR 14 (INTERMEDIATE)

Cutting Edge Japanese Technologies (Systems and Equipment): SHASE Annual Award for New Buildings in 2013

Track: International Design

Room: Sutton Center

Chair: Shinsuke Kato, Ph.D., Fellow ASHRAE, University of Tokyo Institute of Industrial Science, Tokyo, Japan



Three new buildings which were awarded by SHASE in 2013 are introduced, two of which are R and D centers of major construction companies and another is a building housing one of the fastest computers in the world.

1. Energy-Saving Technologies Incorporated in Low-Carbon Office Building: Air-Conditioning System that Combines a Centralized Ductless Air-Conditioning System and Heat Pump Package Systems and Efficient Utilization of Indirect Lighting

Yuichi Takemasa, Ph.D., P.E., Member, Kajima Technical Research Institute, Tokyo, Japan

2. Advanced Office with Low Carbon and High Workplace Productivity Targeting ZEB

Tsuyoshi Itoh, P.E., Obayashi Corporation, Nagoya, Japan

3. A Highly Efficient and Reliable MEP System to Support the Stable Operation of Supercomputer "K"

Yuhei Seki, Nikken Sekkei, Tokyo, Japan

1:30 PM-3:00 PM

SEMINAR 15 (INTERMEDIATE)

Fault Detection, Diagnostics and Control for Packaged Commercial Rooftop and Split Residential Units: What's New?

Track: Commissioning, Operation and Maintenance

Room: Rendezvous Trianon

Sponsor: 07.05 Smart Building Systems, SPC 207P, 07.03 Operation and Maintenance Management

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



Packaged rooftop units (RTUs) condition 69% of cooled commercial floor space in the U.S., and 60% of U.S. homes use central air-conditioning equipment, yet many of these systems are poorly operated and maintained. Fault detection and diagnostics (FDD) and new control approaches provide means to improve operations and transform how maintenance is performed. Recent activities are linking control of air conditioners and other equipment, integrating requirements for FDD into energy codes, developing standard laboratory test methods to support such requirements, and developing and field testing FDD methods for residential and commercial units. This seminar provides the latest on these developments.

1. Transactional Network for Commercial Buildings

George R. Hernandez, P.E., U.S. Department of Energy, Washington, DC

2. Is This My Fault? A Lab Assessment of an In-Field Fault Detection and Diagnostics Tool on a Residential Split System Air Conditioner

Sean Gouw, Associate Member, Southern California Edison (SCE), Irwindale, CA

3. Standards for Fault Detection and Diagnostics in Packaged Commercial Air Conditioning Systems

Kristin Heinemeier, Ph.D., P.E., Member, Western Cooling Efficiency Center, Davis, CA

4. Very-Low Cost Smart Monitoring and Diagnostic System for Packaged Air Conditioners and Heat Pumps

Yunzhi (Lucy) Huang, Member, Pacific Northwest National Laboratory, Richland, WA

1:30 PM-3:00 PM

SEMINAR 16 (INTERMEDIATE)

Efficient Technologies That Are Also Economically Sustainable, Part 2 of 3: Combined Heat & Power (CHP) and Complementary Options

Track: Hydronic System Design

Room: Trianon

Sponsor: 01.10 Cogeneration Systems, TC 06.02 District Energy, TC 06.09 Thermal Storage

Chair: Richard Sweetser, Member, Exergy Partners Corp., Herndon, VA

Combined Heat and Power (CHP) systems are highly efficient hydronic systems that are increasingly being used particularly in urban centers and as electric grid resiliency solutions. CHP systems provide individual buildings, campus sites and district energy systems with energy and economic solutions when properly designed. Background, theoretical and actual CHP, Thermal Energy Storage (TES) and District Energy systems are presented and analyzed during this seminar.

1. CHP Overview and Benefits

Lucas B. Hyman, P.E., Member, Goss Engineering, Inc., Corona, CA

2. Integration Design Issues

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

3. Case Study from Houston, Texas: District Energy with CHP and TES

Blake E. Ellis, P.E., Member, Burns & McDonnell, Kansas City, MO



3:15 PM-4:45 PM

SEMINAR 17 (INTERMEDIATE)

Efficient Technologies That Are Also Economically Sustainable, Part 3 of 3: Thermal Energy Storage (TES) and Complementary Options

Track: Hydronic System Design

Room: Trianon

Sponsor: 06.09 Thermal Storage, 01.10 Cogeneration, 06.02 District Energy

Chair: Geoffrey C. Bares, Associate Member, CB&I, Plainfield, IL

This is the final seminar in a three part series exploring the inherent synergies between District Energy systems, Combined Heat & Power generation, and Thermal Energy Storage (TES), focusing more closely on the benefits of TES. After a brief introduction to TES, its applications, and its advantages, this session explores TES in practice through specific case studies and demonstrates the truly sustainable value of TES now and in the foreseeable future.

1. Thermal Energy Storage Overview and Benefits

Guy S. Frankenfield, P.E., Member, DN Tanks, Grand Prairie, TX

2. Case Studies: Ice TES for District Cooling in Miami-Dade County

Andre LeBlanc, ConEdison Solutions, Miami, FL



3. The Ever-Growing Value Proposition of TES
Mark MacCracken, P.E., Member, CALMAC Manufacturing Corp,
Fair Lawn, NJ

Monday, January 20

8:00 AM-9:30 AM

TECHNICAL PAPER SESSION 4

Energy Master Planning for Low Energy Communities, Part 1

Track: Fundamentals and Applications

Room: Rendezvous Trianon

Chair: Katherine Hammack, Member, US Army, Washington, DC

The influence of increasing oil prices, the effects of climate change, and the desire to become independent of fossil fuel imports have stimulated many countries and their communities to set ambitious goals to reduce energy use and to increase the relative amount of energy derived from renewable energy sources in their total energy consumption.

1. Energy Master Planning towards Net-Zero Energy Communities/Campuses (NY-14-010)

Alexander Zhivov, Ph.D.¹, Richard J. Liesen, Ph.D.¹, Michael Case, Ph.D., Associate Member¹, Jacques Kimman² and Wendy Broers², (1)Engineer Research & Development Center, Champaign, IL, (2)Research Institute for the Built Environment of Tomorrow (RiBuilT) Zuyd University, Heerlen, Netherlands

2. A Computational Framework for Low Energy Community Analysis and Optimization (NY-14-011)

Michael Case, Ph.D., Associate Member¹, Richard J. Liesen, Ph.D., Member¹, Alexander Zhivov, Ph.D., Member¹, Matthew Swanson, Ph.D.¹, Benjamin Barnes¹ and James Stinson², (1)Engineer Research & Development Center, Champaign, IL, (2)U.S. Army Engineer Research and Development Center, Vicksburg, MS

3. Community-Scale Energy Supply and Distribution Optimization Using Mixed Integer Linear Programming (NY-14-012)

Alexander Zhivov, Ph.D.¹, Michael Case, Ph.D., Associate Member¹, Richard J. Liesen, Ph.D.¹, Matthew Swanson, Ph.D.¹, Benjamin Barnes¹ and James Stinson², (1)Engineer Research & Development Center, Champaign, IL, (2)U.S. Army Engineer Research and Development Center, Vicksburg, MS

8:00 AM-9:30 AM

CONFERENCE PAPER SESSION 5 (INTERMEDIATE)

Building Performance Enhancement through Modeling and Control

Track: Building Information Systems

Room: Mercury

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

Modeling of buildings is the starting point of building performance enhancement, and enables researchers to investigate several control strategies before implementation for optimum building operation energy savings. This session explores a calibrated building model, a linear dispersion ductwork systems analysis, and various building control technologies and their energy saving potential.

1. Modeling a Multi-Purpose Public Building with Stochastic Gains and Occupancy Schedules (NY-14-C015)

Justin C. DeBlois, Student Member, William O. Collinge, Melissa M. Bilec, Ph.D., Alex K. Jones and Laura A. Schaefer, Ph.D., University of Pittsburgh, Pittsburgh, PA

2. Building Control Technologies: Campus BAS Upgrade (NY-14-C016)

Brian K. Bozell, Member¹ and Ken Law², (1)Environmental Systems Design, Inc. (ESD), Chicago, IL, (2)CBRE, Chicago, IL

3. Cloud Integrated Monitoring and Remedial Control for Facilities through the Recognize-and-Collaborate Paradigm (NY-14-C017)

Thomas G. Freund, Dig.y.Sol, West Hartford, CT

4. "Low-Tech/No Cost" Control Strategies to Save Energy in K-12 Schools (NY-14-C018)

Raymond C. Tesiero III, Student Member¹, Nabil Nassif, Ph.D., P.E., Member¹, Carol Graydon, Student Member² and Harmohindar Singh, Ph.D., Member¹, (1)North Carolina A&T State University, Greensboro, NC, (2)Guilford County Schools, Greensboro, NC

5. High-Resolution Performance Analysis of a Large Building with Linear Dispersion Ductwork Systems (NY-14-C019)

Anthony Fontanini¹, Michael G. Olsen, Ph.D., Umesh Vaidya, Ph.D. and Baskar Ganapathysubramanian, Ph.D., Iowa State University, Ames, IA

8:00 AM-9:30 AM

CONFERENCE PAPER SESSION 6 (INTERMEDIATE)

Indoor Air Quality: Impact of Variables

Track: Indoor Environmental Health/

Indoor Environmental Quality

Room: Sutton North

Chair: John Dunlap, Dunlap and Partners, Richmond, VA

This session explores the impact of various air delivery methods, air filtration methods and air treatment technologies on indoor air quality. In addition, the role air systems and room variables play in the spread of air-borne contaminants is examined.

1. Breathing and Cross-Infection Risk in the Micro-Environment Around People (NY-14-C020)

Peter V. Nielsen, Ph.D., Jan Zajac, Michal Litewnicki and Rasmus L. Jensen, Ph.D., Aalborg University, Aalborg, Denmark

2. Effect of Chemical Reactions in the Personal Micro-Environment on Inhaled Air Quality (NY-14-C021)

Jackie S. Russo, Ph.D.¹ and H. Ezzat Khalifa, Ph.D., Fellow ASHRAE², (1)Carrier Corporation, Syracuse, NY, (2)Syracuse University, Syracuse, NY

3. Interpersonal Transport of Droplet Nuclei Among Three Manikins in a Full-Scale Test Room (NY-14-C022)

Li Liu, Ph.D., Member¹, Peter V. Nielsen, Ph.D.¹, Rasmus L. Jensen, Ph.D.¹ and Yuguo Li, Ph.D., Fellow ASHRAE², (1) Aalborg University, Aalborg, Denmark, (2)Hong Kong University, Hong Kong, China

4. Ultraviolet Germicidal Irradiation (UVGI) in Hospital HVAC Decreases Ventilator Associated Pneumonia (NY-14-C023)

Robert Scheir, Ph.D., Member and Timothy Leach, Steril-Aire, Burbank, CA

5. Biowall: A Sustainable Approach to Indoor Air Quality (NY-14-C024)

Brenton S. Dunham, Student Member, William Hutzel, P.E., Fellow ASHRAE and Ian Hahus, Purdue University, West Lafayette, IN

8:00 AM-9:30 AM

SEMINAR 18 (INTERMEDIATE)

Challenges in Identifying Low-GWP Refrigerant for High Ambient Temperature Climates

Track: Refrigeration

Room: Regent

Chair: Walid Chakroun, Ph.D., Fellow ASHRAE, Kuwait University, Kuwait, Kuwait

The challenges in meeting the freeze and reduction targets for HCFCs are more pronounced for high ambient temperature countries. These challenges include unclear global trend about definite refrigerant for each category of application, particularly those suitable to operate in high-ambient conditions; unavailability of components, mainly compressors, that work with newly developed or in-development low-GWP refrigerants; the behavior of HVAC systems and their efficiencies, which are still not clearly determined when operating in high ambient temperature; the absence of relevant codes/standards that can facilitate the introduction of low-GWP alternatives and deal with its flammability in most concerned developing countries; limiting introduction of applications with flammable characteristics in high-rising buildings, which has become a notable segment of development in many countries; and low-GWP refrigerants' cost implication on the final products, particularly for price sensitive products.

1. Challenges when it Comes to High Ambient Temperatures

Walid Chakroun, Ph.D., Fellow ASHRAE, Kuwait University, Kuwait, Kuwait

2. UNIDO Perspectives, High Ambient Temperature

Nielsen Ole Reinholdt, P.Eng., UNIDO, New York, NY

3. UNEP Perspectives, High Ambient Temperature

Ayman Eltalouny, P.Eng., Member, UNEP, Bahrain, Bahrain

4. Low-GWP Refrigerants in High Ambient Countries: Challenge or Opportunity?

Bassam Elassaad, P.Eng., Member, UNEP Consultant, Brussels, Belgium

Monday, January 20 39

8:00 AM-9:30 AM

SEMINAR 19 (INTERMEDIATE)

Energy Efficient Single Pipe Hydronic System Design for Large and Tall Buildings

Track: *Hydronic System Design*

Room: *Trianon*

Sponsor: *07.01 Integrated Building Design, 01.05 Computer Applications*

Chair: *Joe Simmons, P.E., Member, HVAC Solution, Salt Lake City, UT*

Imagine an optimal hydronic HVAC system for commercial buildings. What benefits would it deliver? First it would provide comfort to all zones. Second, it would be easy to install, operate and maintain. Third, it would be competitive on a first-and operating-cost basis. Lastly, it would conserve the use of materials and be energy-efficient, a must in the "green"-environment. Since the 1950's a system providing these benefits has been available, the single-pipe hydronic system. These systems, however, traditionally have been limited to residential applications. But with an innovative application of proven hydronic technology, single-pipe systems now can be applied readily to all types of commercial buildings.

1. Energy Efficient Single Pipe Hydronic System Design for Large and Tall Buildings

Greg Cunniff, P.E., Member¹ and Kirk T. Mescher, P.E., Member², (1) TACO, Cranston, RI, (2)CM Engineering, Inc., Columbia, MO



8:00 AM-9:30 AM

SEMINAR 20 (BASIC)

Make the Most of Your ASHRAE Experience

Track: *Fundamentals and Applications*

Room: *Sutton Center*

Sponsor: *Conferences and Expositions Committee*

Chair: *Dunstan Macauley, P.E., Member, TAI Engineers, Owings Mills, MD*

What's the purpose of ASHRAE? How is it structured? What's a TC, SPC and all the other acronyms I hear? Where is the AHR Expo? And, how does this all fit together? This seminar is perfect for first-time attendees or anyone else who would like to get more out of their ASHRAE Winter Conference experience.



8:00 AM-9:30 AM

SEMINAR 21 (INTERMEDIATE)

Cutting Edge Japanese Technologies (Systems and Equipment): SHASE Annual Award for Retrofitted Buildings in 2013

Track: *International Design*

Room: *Sutton South*

Chair: *Shin-ichi Tanabe, Ph.D., Fellow ASHRAE, Department of Architecture, Waseda University, Tokyo, Japan*

Three retrofitted buildings awarded by SHASE in 2013 are introduced. One is the R & D center of a construction company and the others are office buildings.

1. New Renovation Technologies using a Unitized Thin Double-Skin System and Personal Air-Conditioning System for an R&D Center in Yokohama

Kazuyoshi Harimoto, Ph.D., Taisei Corporation, Tokyo, Japan

2. Cutting-Edge HVAC Systems and BEMS: Technology that Satisfies Both Energy Reduction and Workplace Amenities

Shintaro Sakamoto, Ph.D., Shinryo Corporation, Tokyo, Japan

3. Multi-Split Type Air-Conditioning System with Improved Energy Efficiency and Comfort

Hiroaki Nakagawa, Takenaka Corporation, Osaka, Japan



8:00 AM-9:30 AM

WORKSHOP 9 (BASIC)

CoF Debate: Manufacturers are the Real Designers

Track: *Systems and Equipment*

Room: *Beekman*

Sponsor: *College of Fellows*

Chair: *Victor Goldschmidt, Fellow ASHRAE, Consultant, Northport, MI*

There is a mutual reliance between manufacturer and designer. Does this reliance carry through in practice? This is in the series of Fellows Debates which address very important issues in the HVAC industry. The format shows how opposite arguments must be considered as the industry moves forward. Each speaker presents a team by team opening argument. The audience joins in the debate before closing argument. Lots are drawn on Sunday evening for which side each team will argue. No vote is taken.

1. Team 1

Larry Spielvogel, P.E., Fellow Life Member¹, George Adams² and Thomas E. Watson, P.E., Presidential Fellow Life Member³, (1)Consulting Engineer, Bala Cynwyd, PA, (2)CIBSE President, FCIBSE, SPIE Matthew Hall, London, England, (3)McQuay International, Staunton, VA

2. Team 2

Richard Rooley, Presidential Fellow Life Member¹, Don Beaty, P.E., Fellow ASHRAE² and Bill Coad, P.E., Presidential Fellow Life Member³, (1)Rooley Consultants, Bucks, United Kingdom, (2)DLB Associates, Eatontown, NJ, (3)Coad Engineering Enterprises, St Louis, MO

9:45 AM-10:45 AM

TECHNICAL PAPER SESSION 5 (INTERMEDIATE)

Advanced Residential HVAC System Studies: Humidity Control Options, Solar PV Integration, and Multi-function Integration

Track: *Systems and Equipment*

Room: *Regent*

Sponsor: *08.11 Unitary and Room Air Conditioners and Heat Pumps*

Chair: *Van D. Baxter, P.E., Fellow ASHRAE, Oak Ridge National Laboratory, Oak Ridge, TN*



This session summarizes investigation of selected HVAC system issues in high-efficiency or low-energy buildings. The first paper discusses results of ASHRAE RP 1449, an evaluation of predicted energy use and space humidity levels for a wide variety of space conditioning systems in several buildings. Paper 2 discusses benefits of integrating a solar photovoltaic thermal collector (PV/T) with a multi-capacity air source heat pump in a low-energy residence in a northern climate. The last paper discusses a laboratory evaluation of a combined space conditioning and water heating heat pump designed to simulate 24-hour residential heating demands in a range of locations.

1. Energy Efficiency and Cost Assessment of Humidity Control Options for Residential Buildings (RP-1449) (NY-14-013)

Hugh Henderson, P.E., CDH Energy Corp., Cazenovia, NY

2. Theoretical Estimation of the Performance of a Photovoltaic-Thermal Collector (PV/T) System Coupled with a Heat Pump in a Sustainable House in Toronto (NY-14-014)

Raghad Kamel and Alan Fung, Ph.D., P.E., Member, Ryerson University, Toronto, ON, Canada

3. Experimental Evaluation of a Multi-Purpose Heat Pump for Space Heating and Domestic Hot Water Draw (NY-14-015)

Yongfang Zhong, Ph.D., Gas Technology Institute, Des Plaines, IL

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 7 (INTERMEDIATE)

Building Modeling Approaches for Unique Geography and Climates

Track: *International Design*

Room: *Sutton Center*

Chair: *Pam Immekus, Leppard Johnson & Associates, Tucker, GA*



Building information modeling (BIM) and building simulations has become a global issue. As the technology develops the challenges grow in obtaining data for simulations and modeling that is more specific to designs in weather for area of the globe in climates that range from desert to sub-tropical; in insulation this is viable for "Green" buildings; and in bridging cultural challenges in in building modeling in an international market. This session explores these informational aspects of modeling.

1. Simplified Approach to Weather Analysis for Detailed Thermal Simulation in Tropical and Subtropical Areas (NY-14-C025)

Eric F. Hernandez, P.E., Associate Member, KE Fibertec Mexico, Mexico

2. Performance Evaluation of External Insulation and Finish Systems using Vacuum Insulation Panels for Low-Energy Apartment Buildings (NY-14-C026)

Sihyun Park, Member¹, Bo-Kyoung Koo, Ph.D., Member¹, Jae-han Lim, Ph.D., Member¹, Seong-Ryoung Ryu, Ph.D., Member² and Seung-Yeong Song, Ph.D., Member¹, (1)Ewha Womans University, Seoul, South Korea, (2)POSCO E&C, Incheon, South Korea

3. Building Information Modeling: Adapting Design Across Global Markets (NY-14-C027)

C. Alex McCarthy, P.E., Member, SmithGroupJJR, Washington, DC

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 8 (INTERMEDIATE)

Residential Heat Pump System Performance

Track: Systems and Equipment



Room: Beekman

Chair: Jeffrey D. Spitler, Ph.D., P.E., Fellow ASHRAE, Oklahoma State University, Stillwater, OK

The three papers presented in this session cover aspects of residential heat pump system performance not commonly addressed in the literature. The first two papers address, among other things, how backup electric resistance heating can be reduced in ground-source and air-source heat pump systems. The first and third papers cover domestic water heating with an integrated house-heating+domestic-water-heating unit and a dedicated domestic hot water heat pump.

1. Design of Residential Ground Source Heat Pump Systems for Heating Dominated Climates – Trade-Offs Between Ground Heat Exchanger Design and Supplementary Electric Resistance Heating (NY-14-C028)

Signhild E. A. Gehlin, Ph.D., Member¹ and Jeffrey Spitler, Ph.D., P.E.², (1)Swedish Centre for Shallow Geothermal Energy, Lund, Sweden, (2) Oklahoma State University, Stillwater, OK

2. Residential Heating Efficiency Comparison for Differing Heat Pump Types and Sizing Methods (NY-14-C029)

Walter E. Hunt, Associate Member¹, George Gurlaskie² and Ronald Domitrovic, Ph.D., Associate Member¹, (1)Electric Power Research Institute, Knoxville, TN, (2)Duke Energy, Lake Mary, FL

3. Regional Variation in Residential Heat Pump Water Heater Performance in the U.S. (NY-14-C030)

Jeff Maguire, Jay Burch, Tim Merrigan and Sean Ong, National Renewable Energy Laboratory, Golden, CO

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 9 (INTERMEDIATE)

Getting to Green: Where's the Value in "Next Level" Operations and Retro-CX? And your Energy Audit is Worthless...or is it?

Track: Commissioning, Operation and Maintenance



Room: Rendezvous Trianon

Chair: Justin Seter, Member, DLB Associates, Atlanta, GA

This session contains three presentations relating to the ever present topic of maintaining (or pursuing) efficient operation of the built environment. The first presentation covers an in depth look at the operations practices required for high performance buildings and the associated benefits. The second, a case study of an expansive campus retro-cx effort with impressive economics. The third, an examination of what should have been comparable energy audits on the same building, with conclusion and results that may surprise you. There will be some discussion of the need for validation of energy audits and the industry tools used to produce them.

1. An Approach to Improved Indoor Air Quality and Operations of Buildings: Adopt Smart Building Technologies and Train Operations and Maintenance Staff for Required Competencies (NY-14-C031)

Om Taneja, Ph.D., P.E., Member, US General Services Administration, Manhattan, NY

2. A Large Corporate Headquarter Retro-Commissioning: How Changes Produced Significant Energy Savings (NY-14-C032)

Lixia Wu, Ph.D., Member¹ and Mingsheng Liu, Ph.D., P.E., Member², (1)Bes-Tech, Inc., Philadelphia, PA, (2)Bes-Tech, Inc., Omaha, NE

3. A Case Study of Multiple Energy Audits of the Same Building: Conclusions and Recommendations (NY-14-C033)

David W. Gerlach, Ph.D., P.E., Member, Russell Taylor, Stella Oggianu and Marija Trcka, United Technologies Research Center, East Hartford, CT

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 10 (INTERMEDIATE)

The Human Factor – Better Understanding of Comfort, Environment, and Risks

Track: Indoor Environmental Health/

Indoor Environmental Quality

Room: Sutton North

Chair: Michelle Contri, P.E., Member, DLB Associates, Eatontown, NJ



Three presentations with a wide variety of information on different scopes of the HVAC industry. All at the same time relates to increasing the thermal comfort and understanding environmental impacts in a building. The first presentation looks at the effects of second hand smoking in outdoor areas in relation to the weather. Data was collected indoors and outdoors for second hand smoke concentration levels. The second presentation looks at risk assessment methodologies. The case study was detailed on a threat-based approach, but also overviews a vulnerability approach. The third presentation details the thermal comfort of an Underfloor Air Distribution System with an overview of the field study prior to design.

1. Effects of Outdoor Smoking Areas and Weather Conditions on Indoor Air Quality (NY-14-C034)

Terry Sullivan, Ph.D., John Heiser, Tom Watson, Ph.D. and Paul Kalb, Brookhaven National Laboratory, Upton, NY

2. Evaluation of Building-Specific Threat-Based Security Metrics (NY-14-C035)

Ponkamon Aumpansub, Associate Member¹, William P. Bahnfleth, Ph.D., P.E., Presidential Fellow ASHRAE² and Jason W. DeGraw, Ph.D., Member², (1)Havtech Inc., Columbia, MD, (2)Pennsylvania State University, University Park, PA

3. A Field Study of Occupant Thermal Comfort in a LEED Platinum Office Building with an Underfloor Air Distribution System (NY-14-C036)

Chad Miller, Student Member, Zachary Heise, Student Member and Huaifen Hu, Ph.D., Associate Member, Portland State University, Portland, OR

9:45 AM-10:45 AM

SEMINAR 22 (INTERMEDIATE)

Commercial Building Energy Efficiency and High Performance HVAC

Track: Fundamentals and Applications

Room: Trianon

Sponsor: Student Activities Committee

Chair: Joel Primeau, P.Eng., Member, GENIVAR, Ottawa, ON, Canada

This session illustrates what measurements (EUI) are in place to determine commercial building energy efficiency, what the average commercial building efficiencies are in North America, what the DOE benchmarks are for federal buildings, how this compares to ASHRAE Standards 90.1 and 189.1; plus, how HVAC systems could play integral part in high performance buildings. This session also illustrates why the HVAC industry is, and should be, the leader to establish the measurement of commercial building energy efficiency and how this will affect the future of commercial buildings.

1. Commercial Building Energy Efficiency and High Performance HVAC

Douglas F. Zentz, Ferris State University, Big Rapids, MI



9:45 AM-10:45 AM

SEMINAR 23 (INTERMEDIATE)

Cutting Edge Japanese Technologies (Indoor Environmental Health/ Quality): SHASE Annual Award for Separate Sensible Heat and Latent Heat Process Systems in 2013

Track: International Design

Room: Sutton South

Chair: Tatsuo Nobe, Ph.D., Member, Kogakuin University, Tokyo, Japan

Although sensible and latent forms of heat are best separately handled, it has been difficult to do so to date, for various reasons. These SHASE-awarded technologies provide solutions.

1. Air-Conditioning Planning for Project F Aimed at Indoor Environment and Energy Conservation Balance

Hiroshi Shimizu, Shimizu Corporation, Tokyo, Japan



2. Development of an Air-Handling Unit with Multistage Heat Exchanger Coils Targeting a Comfortable Indoor Environment
Kunihiko Kitamura, Ph.D.¹, Yasutaka Murata, Ph.D.² and Osamu Ishihara, Ph.D.³, (1)Kyudenko Corporation, Fukuoka, Japan, (2)Sojo University, Kumamoto, Japan, (3)Shokei College, Kumamoto, Japan

9:45 AM-10:45 AM

SEMINAR 24 (INTERMEDIATE)

Vital Information Input for Your BAS to Make the Laboratory Environment Safer and More Energy Efficient

Track: Building Information Systems

Room: Mercury

Sponsor: 09.10 Laboratory Systems

Chair: So-Yeng Chen, Member, InterCultural Engineering, Inc., Los Angeles, CA

Today, Building Automation Systems (BAS) is becoming a complete systems approach with numerous goals to accomplish. It is not a mere sum of parts but a comprehensive system which needs to take the lab users' behavior into account in order to control the critical areas which influence the effective air management system the most while achieving energy savings as well. This session introduces you to the latest approach with qualitative and quantitative examples to show you what can be accomplished.

1. Integrated BAS to Help People Save Energy in Laboratories

James Coogan, P.E., Member, Siemens, Buffalo Grove, IL

2. The First Step of Demand Control Ventilation in an Animal Facility in Japan: Design and Commissioning for Flexible Ventilation

Masaya Ishihara, Azbil Corporation Building Systems Company, Tokyo, Japan



11:00 AM-12:00 PM

CONFERENCE PAPER SESSION 11 (INTERMEDIATE)

Energy Modeling in Saudi Arabia; Plug Load Management

Track: Building Information Systems

Room: Mercury

Chair: Hyojin Kim, Member, The Catholic University of America, Washington, DC



This session combines two topics related to controlling energy costs in buildings. A paper on an energy modeling software program developed for Saudi Arabia addresses the fact that 70% of the homes are not insulated. Two papers seek to reduce the building energy use associated with plug loads. One describes plug load management devices at a high performance and sustainability facility; the other shows how advanced power strips can be used to mitigate wasted energy.

1. Local Building Materials Database and Energy Modeling Software for Saudi Arabia (NY-14-C037)

Ayman Youssef, P.E., Member and Adel Hamid, Member, Saudi Aramco, Dhahran, Saudi Arabia

2. Energy Analysis of Multi-Function Devices in an Office Environment (NY-14-C038)

Rodney A. Martin, Ph.D. and Scott Poll, NASA Ames Research Center, Moffett Field, CA

3. Reducing Office Plug Loads through Simple and Inexpensive Advanced Power Strips (NY-14-C039)

Michael Sheppy, Associate Member, Ian Metzger, Associate Member and Dylan Cutler, Associate Member, National Renewable Energy Laboratory, Golden, CO

11:00 AM-12:00 PM

CONFERENCE PAPER SESSION 12 (INTERMEDIATE)

Topics in Field Measurements of Building Performance

Track: Commissioning, Operation and Maintenance

Room: Beekman

Chair: Eric W. Adams, Ph.D., Member, Carrier, Syracuse, NY



Measured field data is critical for improving building modeling and understanding building performance (e.g. energy and IAQ). In this session, we combine two examples from multi-unit residential buildings with example measurements of the ASHRAE headquarters building. Air movement, energy modeling, and indoor air quality are common themes. In multi-unit residential housing, air leakage to / from individual units is not necessarily to non-conditioned spaces. Energy and IAQ is exchanged between units and common areas, among units, and to the environment. In the first paper testing for air leakage in a multi-unit housing project is examined in detail to obtain a model to predict air leakage to outside given total leakage. In the second, the impact of building renewal on the energy consumption of the building and the ability of the corridor pressurization systems to provide appropriate ventilation is examined. In the case of the ASHRAE headquarters, the interaction of the water-to-air heat pumps, the open office floor plan, and the DOAS led to actual office conditions that deviated significantly from the predictions.

1. Predicting Envelope Leakage in Multifamily Buildings (NY-14-C040)

Omari Faakyee and Dianne Griffiths, Member, Steven Winter Assoc., Norwalk, CT

2. The Measured Impacts of Building Enclosure Renewals on HVAC System Performance and Energy Efficiency (NY-14-C041)

Andrew Pape-Salmon, P.Eng., Member¹, Lorne Ricketts, Student Member² and Brittany Hanam, P.Eng., Associate Member², (1)RDH Building Engineering Ltd., Victoria, BC, Canada, (2)RDH Building Engineering Ltd., Vancouver, BC, Canada

3. Comparison of Measured and Predicted Ground Source Heat Pump System Operations for the ASHRAE Headquarters Building (NY-14-C042)

Ramandeep Singh, Student Member and Daniel E. Fisher, Ph.D., P.E., Fellow ASHRAE, Oklahoma State University, Stillwater, OK

11:00 AM-12:00 PM

CONFERENCE PAPER SESSION 13 (INTERMEDIATE)

Three Studies of Cooling System Enhancements

Track: Systems and Equipment

Room: Sutton Center

Chair: Alonzo Blalock, P.E., Member, Jacobs, Fort Worth, TX



TECHNICAL PAPER SESSION 6 (INTERMEDIATE)

Energy Master Planning for Low Energy Communities, Part 2

Track: Systems and Equipment

Room: Trianon

Chair: Alexander Zhivov, Ph.D., Engineer Research & Development Center, Champaign, IL



The influence of increasing oil prices, the effects of climate change, and the desire to become independent of fossil fuel imports have stimulated many countries and their communities to set ambitious goals to reduce energy use and to increase the relative amount of energy derived from renewable energy sources in their total energy consumption. The most ambitious goal is to become independent of fossil fuel imports. These papers describe projects by the U.S. Army in building zero-energy communities.

1. From US Army Installation to Zero Energy Community: The B&O Bad Aibling Park Looks to the Future (NY-14-016)

Alfred Kerschberger¹ and Ernst Bohm², (1)RK-Stuttgart Architect & Energy Design, Stuttgart, Germany, (2)B&O Stammhaus GmbH & Co. KG, Bad Aibling, Germany

2. Energy Optimization for Fort Carson Combat Aviation Brigade Complex (NY-14-017)

Alexander Zhivov, Ph.D.¹, Dale Herron, Member², Richard J. Liesen, Ph.D.¹, Kai Budde³, Stephan Richter, Ph.D.⁴, Susanne Ochse⁴, Simon Schad⁴, Lon Fiedler⁵, Peter Steitz⁵, Vince Guthrie², Stephen Turner⁶ and Ned Shepherd², (1)Engineer Research & Development Center, Champaign, IL, (2)U.S. Army Corps of Engineers, Champaign, IL, (3)Federal Office of Bundeswehr Equipment, Information, Technology and In-Service Support, Division Quality / Logistics, Germany, Germany, (4)GEF Ingenieur AG, Liemen, Germany, (5) Group Manager Corporate / Industrial - Facilities Engineering, St. Paul, MN, (6)US Army Corps of Engineers, Omaha, NE

3. Multi-Objective Optimal Design of a Near Net-Zero Energy Solar House (NY-14-018)

Scott Bucking, Student Member, Andreas Athienitis, Ph.D., P.E., Member and Radu Zmeureanu, Ph.D., P.E., Member, Concordia University, Montreal, QC, Canada

This session includes three presentations on Computer studies of Cooling System enhancements. The first presentation is on a computer applied method for Sizing CHP systems for Health Care Facilities while reviewing multiple equipment arrangements to meet the thermal load cycles. The second presentation covers a study of a Thermal Energy Storage Control process for refrigeration systems with application to Transport storage and other cooling systems. The third paper presents a study of a method for "Pre-Cooling Return Chilled Water" using cold weather conditions in an economizing method for systems with radiant cooling.

1. An Exergy-Based Algorithm for Optimizing CHP Systems in Health Facilities (NY-14-C043)

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

2. Dynamic Model of a Refrigeration System with Active Thermal Energy Storage (NY-14-C044)

Joseph M. Fasli¹, Casey R. Briscoe, Ph.D., Associate Member², William F. Mohs, Member² and Andrew G. Alleyne, Ph.D.¹, (1)University of Illinois at Urbana-Champaign, Urbana, IL, (2)Ingersoll Rand, Minneapolis, MN

3. Pre-cooling Chilled Water Return: Replacing Yesterday's Strainer Cycle (NY-14-C045)

Reid Hart, P.E., Member¹, Jeff Boldt, P.E., Member² and Michael Rosenberg¹, (1)Pacific Northwest National Laboratory, Richland, WA, (2) KJWW Engineering Consultants, Madison, WI

11:00 AM-12:00 PM

CONFERENCE PAPER SESSION 14 (INTERMEDIATE)

Designs for Thermal Comfort and Energy Savings: Real Practices in School and Office Buildings

*Track: Indoor Environmental Health/
Indoor Environmental Quality*

Room: Sutton North

Chair: Liangzhu (Leon) Wang, Ph.D., Member, Concordia University, Montreal, QC, Canada



School and office buildings are characterized by diverse needs for thermal comfort, air qualities, and dynamic changes of thermal loads. How to balance thermal comfort and energy saving needs by viable solutions remain a challenge. This session presents three practical designs and analyses for achieving both thermal comfort and energy savings in school and office buildings: a case study combining heat recovery and mechanical ventilation systems in a school building; an application of CO₂-based demand-controlled ventilation integrated with economizers in schools; and the evaluation of thermal comfort response of hydronic radiant ceiling systems under increasing thermal loads in office spaces.

1. Indoor Air Environment and Heat Recovery Ventilation in a Passive School Building: A Case Study for Winter Condition (NY-14-C046)

Yang Wang, Jens Kuckelkorn, Fu-Yun Zhao and Hartmut Spliethoff, Technical University Munich, Munich, Germany

2. Energy Analysis of CO₂-Based Demand Controlled Ventilation and Economizer for Air Source Heat Pump in Schools (NY-14-C047)

Nabil Nassif, Ph.D., P.E., Member and Nihal Al Razi, Student Member, (1)North Carolina A&T State University, Greensboro, NC

3. Experimental Evaluation of the Thermal Comfort in an Occupied Office Under Transient Conditions using a Hydronic Radiant Ceiling Cooling System (NY-14-C048)

Manuel Ruiz de Adana, Ph.D., Member, Ines Olmedo, Ph.D. and Fernando Peci, Ph.D., University of Córdoba, Córdoba, Spain

11:00 AM-12:00 PM

CONFERENCE PAPER SESSION 15 (INTERMEDIATE)

The Challenge of Upgrading Tunnel Ventilation Systems: 3 Case Studies

Track: Systems and Equipment

Room: Regent

Chair: Mark Seymour, Member, Future Facilities Ltd, London, England

Providing ventilation systems in tunnels is in itself a challenge. This is particularly so given that the need to provide fresh air and clear pollutants during normal operation must be satisfied alongside provisions to remove smoke or other hazardous gases in the case of fire or accident. Increasing



transport demands frequently require upgraded ventilation or the addition of supplementary ventilation systems in tunnels that were designed decades previously to historic standards. Three case studies present their approach to design, evaluation and selection of ventilation upgrades that can be practically implemented in a retrofit scenario to satisfy current legislation.

1. Working With Constraints: An Interstate Tunnel Retrofit (NY-14-C049)

David G. Newman, P.E., Member¹ and Hing-Wai Wong², (1)Hatch Mott MacDonald, Westwood, MA, (2)Hatch Mott MacDonald, New York, NY

2. Upgrading an Existing Tunnel Ventilation System with Jet Fans and Zoned Transverse Ventilation (NY-14-C050)

Yuan Li, P.E., Member and Igor Maevski, Ph.D., P.E., Member, Jacobs Engineering, New York, NY

3. Conversion of an Existing Transverse Ventilation System to a Longitudinal System Using a Saccardo Nozzle (NY-14-C051)

Jarrod Alston, P.E., Member¹, Deepak Kandra, P.E.² and Richard Potter, P.E.², (1)Arup, Cambridge, MA, (2)Arup, New York, NY

11:00 AM-12:00 PM

SEMINAR 25 (INTERMEDIATE)

Effective Best Practices for Successful Building Systems Commissioning

Track: Commissioning, Operation and Maintenance

Room: Rendezvous Trianon

Sponsor: 07.09 Building Commissioning

Chair: James Vallort, P.E., Member, Environmental Systems Design, Chicago, IL



The concept of commissioning of buildings during new construction and renovation has grown across the globe in the past decade or so. This has paralleled the continued push toward improved designs for energy and water efficiency. Unfortunately, there has been less focus on helping to ensure that there is continued high performance after construction is complete. Monitoring Based Commissioning is presented as a solution. In addition, this seminar explains the testing, adjusting, and balancing functions, and describes the commissioning interface and cooperation with the balancing effort including review of specifications, qualifications, and reports.

1. The Application of Monitoring Based Commissioning to Building Systems

H. Jay Enck, Member, Commissioning & Green Build Solutions Inc., Buford, GA

2. Commissioning and Test, Adjust and Balance: A Team Activity

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

11:00 AM-12:00 PM

SEMINAR 26 (INTERMEDIATE)

Cutting Edge Japanese Technologies (Improving Building Performance through Commissioning, Operation and Maintenance): SHASE Annual Award for Ongoing Commissioning of Energy Performance in 2013

Track: International Design

Room: Sutton South

Chair: Kazuhiko Matsuo, Ishimoto Architectural & Engineering Firm, Inc., Tokyo, Japan



The session discusses a SHASE-awarded building, operating effectively for more than a decade, and a newly constructed training center, which received a SHASE award in 2013. Both buildings focused on commissioning.

1. The Challenge to Realize Electric Power Load-Leveling Buildings with Life-Cycle Energy Management: Measures in Building which Help Stabilize the Energy Supply

Hideki Yuzawa, P.E., Nikken Sekkei Research Institute, Tokyo, Japan

2. Ongoing Energy Performance of Multi-Use Solar Heating and Cooling Systems for Environmentally Conscious Accommodation Facilities in Japan

Yoshihide Yamamoto, Nihon Sekkei Co., Ltd, Tokyo, Japan

2:15 PM-3:45 PM

SEMINAR 27 (INTERMEDIATE)

Improving Sustainability through Mitigation of Refrigerant Emissions: IIR Working Party Seminar

Track: *International Design*

Room: *Trianon*

Sponsor: *IIR*

Chair: *Per Lundqvist, Ph.D., KTH, The Royal Institute of Technology, Stockholm, Sweden*



This seminar will provide information about the impact of leakage, why containment is beneficial from environmental and economic perspectives, where and how leakage can be reduced, legislation and initiatives that have been developed to help containment, based on a comprehensive review of reference of international reports, evidence studies, technical papers and legislation. It is based on a research project initiated by the International Institute of Refrigeration Working Party on behalf of the IIR Science and Technology Council.

1. The Need to Address Refrigerant Leakage and the Role of IIR's Working Party: "Mitigation of Direct Emissions of Greenhouse Gases in Refrigeration"

Per Lundqvist, Ph.D., KTH, The Royal Institute of Technology, Stockholm, Sweden

2. The Global Appetite for Improved Refrigerant Leakage Reduction
Matthew Ritter, Member, Arkema Inc., King of Prussia, PA

3. IIR Informatory Note: Report on Data Collection, Knowledge Gaps and Availability of Information on FRIDOC

David Cowan, P.E.¹ and Issa Chaer, Ph.D.², (1)Institute of Refrigeration, Carshalton, United Kingdom, (2)London South Bank University, London, United Kingdom

4. Achieving Better International Cooperation on Refrigerant Leakage Reduction

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

Tuesday, January 21

8:00 AM-9:30 AM

SEMINAR 28 (ADVANCED)

A Comprehensive Look at Infectious Disease and Air Filtration in Healthcare Facilities: Energy Saving, IAQ Performance, and What Makes You Sick

Track: *Indoor Environmental Health/*

Indoor Environmental Quality

Room: *Sutton North*

Sponsor: *02.04 Particulate Air Contaminants and Particulate Contaminant Removal Equipment, 02.03 Gaseous Air Contaminants and Gas Contaminant Removal Equipment*

Chair: *Zied Driss, Member, Camfil USA, Riverdale, NJ*



Contaminants and transmission of pathogens in healthcare facilities have been known to cause many serious infectious diseases. This seminar sheds light on the important contaminants known today and will provide up-to-date control strategies to meet indoor air quality (IAQ) requirements. The speakers provide real-life examples and strategies.

1. Interstate Highways of Cross Transmission of Microorganisms in Healthcare Facilities: Air, Water and Surfaces – Which is the Most Important?

Russ Olmsted, Trinity Health, Ann Arbor, MI

2. Exceeding Standards for Internal Air Quality while Reducing Energy Consumption and Operating Costs

John Ellis, Intermountain Healthcare, Salt Lake City, UT

3. Utilizing the Existing Air Handler Component for Improvement of the IAQ in Health Care Facilities Without Compromising the Energy Consumption

Phil Maybe, The Filter Man Ltd., New Caney, TX

4. A Survey of Filtration Applications and Considerations in Healthcare
Matt Middlebrooks, Filtration Group, Dallas, TX

5. Building Science Measurements for the Hospital Microbiome Project
Brent Stephens, Ph.D., Associate Member, Illinois Institute of Technology, Chicago, IL

8:00 AM-9:30 AM

SEMINAR 29 (INTERMEDIATE)

Advanced RTU Campaign: Accelerating Efficiency

Track: *Systems and Equipment*

Room: *Sutton Center*

Sponsor: *02.08 Building Environmental Impacts and Sustainability, 07.06 Building Energy Performance*

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



ASHRAE is working with the Retail Industry Leaders Association, the Department of Energy, and others to accelerate the adoption of high efficiency HVAC practices through the Advanced RTU Campaign (ARC). The Advanced RTU Campaign (ARC) provides resources to commercial building owners and operators to evaluate their stock of rooftop air conditioning units (RTUs), replace older units with high-efficiency ones, and retrofit other RTUs with advanced controls in order save money and energy, make your building more comfortable, and help the environment.

1. Introduction to the Advanced RTU Campaign

Amy Jiron, U.S. Department of Energy, Washington, DC

2. Taking Action toward Efficient RTUs

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

3. Keeping the "Efficient" Part in Efficient RTUs: Design Correctly, Install Wisely, Optimize Effectively

Ed Smyth, Associate Member, DNV KEMA, Troy, NY

8:00 AM-9:30 AM

SEMINAR 30 (INTERMEDIATE)

Current Trends in Tall Building Designs

Track: *Tall Buildings: Performance Meets Policy*

Room: *Trianon*

Sponsor: *09.12 Tall Buildings*

Chair: *Ray Sinclair, Ph.D., Member, RWDI, Guelph, ON, Canada*



There is a proliferation of Super Tall and Mega Tall Buildings being built around the world. These buildings exceed the height of the Empire State Building at 380 m. These tall buildings can be very slender on relatively small urban site and have unique forms and mixed-use function. An architect, a structural engineer and a mechanical engineer present on current trends in design that must provide integrated solutions to complex issues that are of interest to ASHRAE members.

1. The Tall Tower as an Integrated Machine

Richard Nemeth, KPF, New York, NY

2. Integrating Architecture and Structure to Optimize Supertall Buildings: Three Case Studies

Dennis Poon, Land Transport Authority, Singapore, Singapore

3. Tall Building Designs: A Mechanical Engineer's Perspective

Mark Yakren, Syska, New York, NY

8:00 AM-9:30 AM

SEMINAR 31 (INTERMEDIATE)

Intelligent Building Operations Workshop Results:

Fault Detection and Diagnostics

Track: *Building Information Systems*

Room: *Rendezvous Trianon*

Sponsor: *07.05 Smart Building Systems*

Chair: *David P. Yuill, P.E., Student Member, Purdue University, West Lafayette, IN*



The Intelligent Building Operations workshop was held in Boulder, CO, June 20 – 22, 2013. Four of the presenters at that workshop who focused on FDD in HVAC systems have been selected to present their results, with updates, in this seminar. They give a manufacturer's perspective on integrating on-board FDD, and FDD developers' insights on methods being developed to diagnose problems at the component level (economizers), equipment level (air handlers & RTU) and in whole buildings. Attendees learn what faults are common, how they affect operation and efficiency, detection and diagnosis methods, and the need for industry standards and integration.

1. Embedding FDD into Residential and Light Commercial Products

Jon Douglas, Member, Lennox Industries, Carrollton, TX

2. Active Economizer Diagnostics for Packaged Air-Conditioners

Andrew L. Hjortland, Student Member, Purdue University, West Lafayette, IN

3. Automated Fault Detection and Diagnosis for AHU-VAV Systems: A Pattern-Matching Approach

Adam Regnier, Student Member, Drexel University, Philadelphia, PA

4. AFDD Expert Assistant: An Automated FDD Tool for Commercial Buildings

Daniel Veronica, Member, National Institute of Standards and Technology, Gaithersburg, MD

8:00 AM-9:30 AM

SEMINAR 32 (INTERMEDIATE)

Optimization Techniques in HVAC

Track: Fundamentals and Applications

Room: Beekman

Sponsor: TGI Optimization, Publications and Education

Chair: Pradeep Bansal, Ph.D., Fellow ASHRAE, Oak Ridge National Laboratory, Oak Ridge, TN

This session offers a select group of recently published papers from the ASHRAE HVAC&R Research Journal regarding new developments in optimization technology to include cost optimization for a large-scale hybrid central cooling plant that uses a realistic nonlinear complex cost structure and examines the trade-off between chiller operations using different energy sources, the peak loads calculation in TRNSYS and EnergyPlus, and an analytical solution for an optimum fin shape.

1. Cost Optimization for a Large-Scale Hybrid Central Cooling Plant with Multiple Energy Sources under a Complex Electricity Cost Structure

Jeonghan Ko, Ph.D., Member¹ and Yin Guo, Member², (1)Ajou University, Korea and the University of Michigan, Ann Arbor, MI, (2)University of Nebraska, Lincoln, NE

2. An Optimum Longitudinal Wet Fin Without the "Length-Of-Arc" Assumption

Balaram Kundu, Ph.D., Debasis Barman and Debkalpa Goswami, Jadavpur University, Kolkata, India

3. Extensive Comparative Analysis of Building Energy Simulation Codes: Heating and Cooling Energy Needs and Peak Loads Calculation in Trnsys and Energyplus for Southern Europe Climates

Andrea Gasparella, Ph.D.¹ and Giovanni Pernigotto, Dr.Ing.², (1)Free University of Bolzano, Bolzano, Italy, (2)University of Padova, Vicenza, Italy

8:00 AM-9:30 AM

SEMINAR 33 (INTERMEDIATE)

Optimized Control Strategies for Chilled Beams and Radiant Panels

Track: Systems and Equipment

Room: Mercury

Sponsor: 06.05 Radiant Heating and Cooling, 05.03 Room Air Distribution

Chair: Devin A. Abellon, P.E., Member, Uponor, Phoenix, AZ

As building owners and design engineers continue to explore hydronic systems as part of an energy efficient design solution in high performance buildings, they are faced with a variety of control strategies to optimize the systems while ensuring that surface condensation does not occur. While there are similarities in how chilled beams and radiant systems are controlled, there are important differences as well. This session covers various strategies and includes a number of case studies.

1. Radiant Heating and Cooling System Fundamentals and Applications

Robert Bean, Member, Healthy Heating, Calgary, AB, Canada

2. Chilled Beam Application Fundamentals

Kenneth J. Loudermilk, P.E., Member, TROX USA, Cumming, GA

3. Control Strategies for Chilled Beams vs. Radiant Panels

Peter Simmonds, Ph.D., Fellow ASHRAE, Stantec, Sherman Oaks, CA

8:00 AM-9:30 AM

SEMINAR 34 (ADVANCED)

Refrigerants Today, Tomorrow, and Beyond

Track: Refrigeration

Room: Regent

Sponsor: Refrigeration Committee, TC8.01 Positive Displacement Compressors, TC10.07, 03.01 Refrigerants and Secondary Coolants

Chair: Georgi S. Kazachki, Ph.D., Fellow ASHRAE, Dayton Phoenix Group, Inc., Dayton, OH

Refrigerants have been and will be the defining factor in the design of refrigerating and air-conditioning equipment from the onset of artificial cooling to present days and into the future. Their chemical and thermo-physical properties determine the performance of each component individually as well as the performance of the entire system: refrigerating capacity, energy efficiency, temperature and pressure levels, heat transfer, oil circulation, system chemistry, reliability, lifetime, environmental and physiological impact. This seminar illustrates the impact of the refrigerants of today, tomorrow, and beyond on all aspects of practical use of residential, commercial, and industrial refrigeration and air-conditioning.

1. Reducing Ammonia Charge in Industrial Refrigeration Systems Using Direct Expansion

Bruce Nelson, P.E., Member, Colmac Coil Manufacturing, Inc., Colville, WA

2. Performance Ranking of Low Global Warming Potential Alternative Refrigerants

Mark A. Kedzierski, Ph.D., Member¹, J. Steven Brown, Ph.D., P.E., Member² and J. Koo³, (1)National Institute of Standards and Technology, Gaithersburg, MD, (2)The Catholic University of America, Washington, DC, (3)Kyung Hee University, Seoul, South Korea

3. Thermal Stability Studies to Evaluate Low-GWP Refrigerants

Bianca W. Hydutsky, Ph.D., Associate Member, DuPont Chemicals and Fluoroproducts, Wilmington, DE

4. Safe and Environment-Friendly Refrigerants for Industrial Process Energy Recovery

Laurent Abbas, Arkema, King of Prussia, PA

8:00 AM-9:30 AM

SEMINAR 35 (INTERMEDIATE)

Sustainable Development in Africa

Track: International Design

Room: Sutton South

Sponsor: 02.08 Building Environmental Impacts and Sustainability, 09.08 Large Building Air-Conditioning Applications

Chair: Thomas E. Watson, P.E., Presidential Fellow Life Member, Daikin Applied, Staunton, VA

Countries on the continent of Africa have great natural resources in terms of minerals, energy, and good climate. However, these resources need to be developed for the benefit of its people. It has a large (around 1 billion) population which is spread across the continent in numerous villages which generally lack the amenities and services which most developed countries take for granted. It would be easy to assume that sustainable development should follow 'western' examples with migration from countryside to modern cities but the opposite is more likely to happen and more sustainable given the wide distribution of natural resources, renewable energy, and people. This seminar identifies key issues and how ASHRAE can be pro-active in guiding Africa toward sustainable development.

1. African Continent's Unique Approach to Sustainability

Frank A. Mills, P.E., Member, Low Carbon Design Consultants, Liverpool, United Kingdom

2. Designing in Sub-Saharan Africa: Revisiting the Past to Achieve Sustainability

Dunstan Macauley, P.E., Member, TAI Engineers, Owings Mills, MD

3. Renewable Energy in Africa

Kayley Lockhead, Student Member¹ and Frank A. Mills, P.E., Member², (1)NG Bailey Engineering, Leeds, United Kingdom, (2)Low Carbon Design Consultants, Liverpool, United Kingdom



9:45 AM-10:45 AM

TECHNICAL PAPER SESSION 7 (INTERMEDIATE)

Monitoring Building Energy Use and Modeling Ice

Thermal Storage

Track: Systems and Equipment

Room: Rendezvous Trianon

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



ASHRAE RP-1404 assesses methods by which short-term in-situ monitoring of weather-dependent building energy use could be used as a workable alternative to yearlong monitoring in monitoring and verification projects. A paper reports on some of the findings. Optimizing cooling with ice thermal storage through a tool is described in another paper. The study considers the effect of the ice thermal storage on the chiller performance and the associated energy cost.

1. An Integrated Heat Transfer Attic and Multi-room Thermal Building Model (NY-14-019)

Ahmed Megri, University of Wyoming, Laramie, WY

2. Optimal Design and Control of Ice Thermal Storage System for a Typical Chilled Water Plant (NY-14-020)

Nabil Nassif, North Carolina A&T State University - Center for Energy Research and Technology, Greensboro, NC

9:45 AM-10:45 AM

TECHNICAL PAPER SESSION 8 (INTERMEDIATE)

Numerical Prediction of Boundary Conditions and Turbulence in the Near Field Region of Low Reynolds Merging Jets

Track: Systems and Equipment

Room: Sutton Center

Chair: Brian Krafthefer, BCK Consulting, Stillwater, MN



Flow from co-planar nozzles converges and merges at a certain distance from the nozzles. In order to numerically predict such confluence, it is crucial to provide inlet boundary conditions for these jets at the nozzle exits. Numerical prediction of inlet boundary conditions and turbulence of merging jets was chosen both because of the difficulty of measurement at the exit of the nozzles and the lack of information about the shape of the employed nozzles to determine artificial inlet profiles. Two turbulence models (Realizable k-ε and RSM) of the supply device producing the confluent jets were verified. For a 3-D array of jets, simulation of the whole domain of confluent round jets is essential in order to predict and study the flow behavior. The existence of an initial, a converging, a merging and a combined region in the confluent jets has been found for three low Reynolds numbers.

1. A Study on Proximal Region of Low Reynolds Confluent Jets, Part 1: Evaluation of Turbulence Models in Prediction of Inlet Boundary Conditions (NY-14-021)

Shahriar Ghahremanian, Student Member and Bahram Moshfegh, P.Eng., Linköping University, Linköping, Sweden

2. A Study on Proximal Region of Low Reynolds Confluent Jets, Part 2: Numerical Prediction of the Flow Field (NY-14-022)

Shahriar Ghahremanian, Student Member and Bahram Moshfegh, P.Eng., Linköping University, Linköping, Sweden

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 16 (INTERMEDIATE)

Residential Hydronic Heat and Daily Hot Water Use

Track: Systems and Equipment

Room: Regent

Chair: James S. McNeill Jr., Student Member, Affiliated Engineers, Inc., Madison, WI



Researchers describe in one paper the optimal combinations of components that result in the highest overall efficiency for a residential hydronic system where baseboard convectors are used as the heat emitter. Another paper describes advances in a solar water heating system solar tube collectors. A third paper identifies typical hot water draw patterns, the results of which are being evaluated for inclusion in Standard 118.2, Method of Testing for Rating Residential Water Heaters.

1. Designing Hydronic Systems to Maximize Efficiency and Response (NY-14-C052)

Lois B. Arena, Associate Member and Omari Faakye, Steven Winter Associates, Inc., Norwalk, CT

2. Typical Hot Water Draw Patterns Based on Field Data (NY-14-C053)

J.D. Lutz, P.E., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

3. Solar Water Heating System with Phase Change Materials and Carbon Nanotube (NY-14-C054)

Fatemeh Hassanipour, Vladimir Pozdin and Anvar Zakhidov, University of Texas at Dallas, Richardson, TX

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 17 (INTERMEDIATE)

Climate Zones and Carbon Emissions

Track: Fundamentals and Applications

Room: Sutton South

Chair: Larry Brand, Member, Gas Technology Institute, Des Plaines, IL



ASHRAE Standard 169 categorizes climates in a way that could be used for energy standards and codes. Changes to the 2013 version of the standard are described in a paper. A revision to ASHRAE Standard 105, "Standard Methods of Determining, Expressing and Comparing building Energy Performance and Greenhouse Gas Emissions," includes compliance requirements related to aver and avoided (or Marginal) primary energy and greenhouse gas emissions associated with building energy performance. The rational for average and marginal methodologies are described in a paper. A third paper describes a model whose purpose is to provide a simple tool to estimate the impact of different RACHP technologies, alternative building design and operating parameters and future global warming, on the energy demands and carbon emissions of buildings.

1. Changes in ASHRAE Standard 169: Implications for Energy Codes and Standards (NY-14-C055)

John Hogan, P.E., Member, Consultant, Seattle, WA

2. Estimation of Cooling Energy Demand and Carbon Emissions from Urban Buildings using a Quasi-Dynamic Model (NY-14-C056)

David Cowan¹, Graeme Maidment, Ph.D.² and Issa Chaer, Ph.D.², (1) Institute of Refrigeration, Carshalton, United Kingdom, (2) London South Bank University, London, United Kingdom

3. Options for Determining Marginal Primary Energy and Greenhouse Gas Emission Factors (NY-14-C057)

Neil P. Leslie, P.E., Member¹ and Marek Czachorski², (1) Gas Technology Institute, Des Plaines, IL, (2) MC Scientific, Downers Grove, IL

9:45 AM-10:45 AM

SEMINAR 36 (INTERMEDIATE)

CFD for Data Center Applications, Part 2 – Applications

Track: Fundamentals and Applications

Room: Mercury

Chair: James VanGilder, P.E., Member, APC by Schneider Electric, Billerica, MA



As evidenced by the number software tools available commercially today, Computational Fluid Dynamics (CFD) is widely employed in the design and management of data centers and has become a vitally important technology in the quest to make these complex and energy-intensive facilities more reliable and energy efficient. In the first part of this two-part seminar, we take a high-level view of the topic and discuss many specific examples of how CFD can be used to pro-actively design and manage data centers.

1. Prediction Is Better Than Cure: CFD Simulation for Data Center Operation

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

2. Practical Use of CFD to Address the Design Challenges and Failure Scenarios in Data Centers

Reza Ghias, Ph.D., Member, Southland Industries, Dulles, VA

9:45 AM-10:45 AM
SEMINAR 37 (BASIC)

Real CoSt of Filtration

Track: *Indoor Environmental Health/*

Indoor Environmental Quality

Room: *Sutton North*

Sponsor: 02.04 Particulate Air Contaminants and Particulate Contaminant Removal Equipment, 02.03 Gaseous Air Contaminants and Gas Contaminant Removal Equipment

Chair: *Kyung-Ju Choi, Ph.D., Member, Clean & Science, Des Plaines, IL*

CoSt vs. Benefits for Residential filters; does upgrading help you breathe better? There is still substantial debate on the energy consequences of better residential filtration, but there has been relatively little examination of the benefits. The purpose of this session is to describe the energy consumption consequences for residential filters with different pressure drops, along with the impact of the different filters on indoor concentration of airborne particles.

1. Impact of Residential HVAC Filtration on Energy Consumption and Indoor Concentration of Particulate Matter

Thad Ptak, Ph.D., Member, Columbus Industries, Columbus, OH

2. The Real Benefits of Residential Filtration

Jeffrey A. Siegel, University of Texas, Austin, TX



9:45 AM-10:45 AM
SEMINAR 38 (INTERMEDIATE)

Advances in Ventilation

Track: *Fundamentals and Applications*

Room: *Beekman*

Sponsor: 04.03 Ventilation Requirements and Infiltration, Publications and Education

Chair: *Pradeep Bansal, Ph.D., Fellow ASHRAE, Oak Ridge National Laboratory, Oak Ridge, TN*

This session offers a select group of recently published papers from the ASHRAE HVAC&R Research Journal regarding new developments in ventilation technology to include research of thermal comfort and energy conservation, reducing exposure to indoor pollutants with personalized ventilation, and minimizing airborne cross infection in aircraft cabins.

1. Investigation on Thermal Comfort and Energy Conservation of Local Ventilation

Zhiwei Lian, Ph.D.¹, Chanjuan Sun¹, Harry Giles, Ph.D., Member², Guoliang Xu, Ph.D.³ and Li Lan¹, (1)Shanghai Jiao Tong University, Shanghai, China, (2)University of Michigan, Ann Arbor, MI, (3)Zhejiang Water Conservancy and Hydropower College, Zhejiang, China

2. Experimental Investigation on Reduced Exposure to Pollutants Indoors by Applying Wearable Personal Ventilation

Zhecho Bolashikov¹, Arsen K. Melikov, Ph.D.² and Michal Spilak³, (1) Danish Technical University, Denmark, (2)Technical University of Denmark, Lyngby, Denmark, (3)Danish State Building Research Institute, Construction and Health, Denmark



9:45 AM-10:45 AM
SEMINAR 39 (ADVANCED)

Specific Engineering Solutions for Tall Buildings

Track: *Tall Buildings: Performance Meets Policy*

Room: *Trianon*

Sponsor: 09.12 Tall Buildings

Chair: *Luke Leung, P.E., Member, Skidmore, Owings and Merrill LLP, Chicago, IL*

One World Trade Center is the primary building of the new World Trade Center complex in New York City's Lower Manhattan. This 104-story supertall skyscraper stands on the northwest corner of the 16-acre (6.5 ha) World Trade Center site. On May 10, 2013, the final component of the skyscraper's spire was installed, making One World Trade Center the tallest building in the Western Hemisphere and the third-tallest building in the world by pinnacle height. Its spire reaches a symbolic height of 1,776 feet (541 m) in reference to the year of the United States Declaration of Independence. It has been the



tallest building in New York City since April 30, 2012, when it surpassed the height of the Empire State Building. This seminar focuses on the comprehensive technical elements of the building, from the high performance curtain wall, energy consumption, elevators, and fire protection to the HVAC system. Focus is on the special systems, energy and human performances of this tallest building in US.

1. One World Trade Center

Nick Holt, SOM, Chicago, IL

11:00 AM-12:30 PM

CONFERENCE PAPER SESSION 18 (INTERMEDIATE)

Heat Pump Systems

Track: *Systems and Equipment*

Room: *Sutton Center*

Chair: *Andrew Rhodes, Southland Industries, Dulles, VA*

Papers in this session describe the effect of refrigerant distribution on seasonal heating and cooling performance, a two-stage desiccant wheel system, a new technique for a dehumidification system, system modeling of a vapor-compression chiller and absorption heat pump, and savings when using a heat pump optimized for cold climates.

1. Evaluation of Seasonal Performance Improvements in a 3-Ton Air-Conditioning Heat Pump System Using a Novel Design of Integrated Electronic Expansion Valves and Distributors (NY-14-C058)

Chad Bowers, Ph.D., Associate Member¹, Dave Wrocklage², Stefan Elbel, Ph.D., Associate Member¹ and Pega Hrnjak³, (1)Creative Thermal Solutions, Urbana, IL, (2)Parker Hannifin Corporation Sporlan Division, Washington, MO, (3)University of Illinois at Urbana-Champaign, Urbana, IL

2. Application of Heat Pump Driven Two-Stage Desiccant Wheel System in Office Buildings (NY-14-C059)

Rang Tu, Member, Xiaohua Liu, Ph.D., Tao Zhang and Yi Jiang, Ph.D., School of Architecture, Tsinghua University, Beijing, China

3. Aerogel-Coated Metal Foams for Dehumidification Applications (NY-14-C060)

Kashif Nawaz, Student Member, Shelly Schmidt, Ph.D. and Anthony Jacobi, University of Illinois at Urbana Champaign, Urbana, IL

4. An Integrated System of Vapor-Compression Chiller and Absorption Heat Pump for Efficiency Improvement: System Modeling and Performance Analysis (NY-14-C061)

Yi-shu Kung, Student Member¹, Ming Qu, Ph.D., Associate Member¹ and Steve Peng, Ph.D.², (1)Purdue University, West Lafayette, IN, (2)California State University, East Bay, Hayward, CA

5. Field Demonstration of a Cold Climate Heat Pump (NY-14-C062)

Stephen Caskey, Student Member¹, Derek Kultgen, Student Member¹, Andreas Gschwend², William Hutzler, P.E., Fellow ASHRAE¹ and Eckhard Groll, Ph.D., Fellow ASHRAE¹, (1)Purdue University, West Lafayette, IN, (2)NTB University of Applied Sciences and Technology, Buchs, Switzerland



11:00 AM-12:30 PM

CONFERENCE PAPER SESSION 19 (INTERMEDIATE)

Low GWP Refrigerants

Track: *Refrigeration*

Room: *Regent*

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

Counterfeit refrigerants, market challenges and the performance of lower global warming potential refrigerants are presented in this timely session.

1. Dangers of Counterfeit Refrigerants (NY-14-C063)

Steve Kujak¹, Robert W. Yost, Member², Warren Clough, Member³ and Marc Scancarello, P.E., Member⁴, (1)Trane, La Crosse, WI, (2)National Refrigerants, Rosenhayen, NJ, (3)Carrier Corp., Syracuse, NY, (4)Emerson Climate Technologies, Inc., Sidney, OH

2. Insights into Design and Market Challenges to Meet a Lower Global Warming Potential (GWP) Refrigerant Future by 2034(NY-14-C064)

Steve Kujak, Member, Trane, La Crosse, WI



3. Performance of R134a Alternative Lower GWP Refrigerants in a Water-Cooled Screw Chiller (NY-14-C065)

Ken Schultz, Ph.D., Member, Trane Co., La Crosse, WI

4. Performance of R410A and R22 Alternative Lower GWP Refrigerants in a Small (~5 RT) Water Chiller (NY-14-C066)

Ken Schultz, Ph.D., Member, Trane Co., La Crosse, WI

5. Evaluation of Alternative Refrigerant Candidates for R410A through Testing and Simulation (NY-14-C067)

Abdullah Alabdulkarem, Student Member, Yunho Hwang, Ph.D., Member and Reinhard Radermacher, Ph.D., P.E., Fellow ASHRAE

11:00 AM-12:30 PM

CONFERENCE PAPER SESSION 20 (INTERMEDIATE)

Development and Creative Application of Building Energy Simulation Tools

Track: Fundamentals and Applications



Room: Sutton North

Chair: Mikhail Koupriyanov, Price, Winnipeg, MB, Canada

With an ever-strengthening trend towards more energy efficient buildings, energy simulation tools have seen extensive use in the last two decades and are constantly evolving. This session demonstrates the creative ways in which energy modeling techniques can be modified and applied to a wide range of engineering problems. The topics include the use of thermodynamic models for on-line supermarket cold room monitoring, the development of optimization methods for building energy simulations, the development of flow equations for modeling and control of exothermic processes in industrial environments, the use of energy modeling for efficient residential housing procurement in harsh climates as well as the effective coupling of building energy and contaminant transport models.

1. Optimization for Whole Building Energy Simulation Method in Façade Design (NY-14-C068)

Rudai Shan, Student Member, University of Michigan, Ann Arbor, MI

2. Development and Validation of Proposed Ventilation Equations for Improved Exothermic Process Control (NY-14-C069)

John L. McKernan, Member¹, Michael J. Ellenbecker², Christina A. Holcroft³ and Martin R. Petersen, Ph.D.⁴, (1)U. of Massachusetts Lowell, Lowell, MA; U.S. EPA, Cincinnati, OH, (2)U. of Massachusetts Lowell, Lowell, MA, (3)Tufts University, Boston, MA; U. of Massachusetts Lowell, Lowell, MA, (4)National Institute for Occupational Safety and Health, Cincinnati, OH

3. High Performance Residential Housing Units at U.S. Coast Guard Base Kodiak (NY-14-C070)

Rachel Romero, Associate Member¹ and John Hickey², (1) National Renewable Energy Laboratory, Golden, CO, (2)Coast Guard Shore Maintenance Command, Seattle, WA

4. Generation of Multizone Airflow Models from Building Energy Models (NY-14-C071)

Jason W. DeGraw, Ph.D., Member¹, Daniel Macumber, Member² and William P. Bahnfleth, Ph.D., P.E., Presidential Fellow ASHRAE¹, (1) Pennsylvania State University, University Park, PA, (2)National Renewable Energy Laboratory, Golden, CO

5. Model Based Estimation of Cold Room Temperatures in Supermarket Refrigeration System (NY-14-C072)

Zheng O'Neill, Ph.D., P.E., Member¹ and Satish Narayanan², (1)The University of Alabama, Tuscaloosa, AL, (2)United Technologies Corporation, East Hartford, CT

11:00 AM-12:30 PM

SEMINAR 40 (INTERMEDIATE)

ASHRAE and Tall Buildings

Track: Tall Buildings: Performance Meets Policy

Room: Trianon

Sponsor: 09.12 Tall Buildings

Chair: Dennis Wessel, P.E., Fellow ASHRAE, Karpinski Engineering, Cleveland, OH



This session presents advancements in ASHRAE produced design guides and documents for tall buildings, such as the proposed changes to the ASHRAE HVAC Tall Building Design Guide and trends in Asian tall buildings. The next generation of super tall buildings promise to be much taller - there are multiple "Megatall" towers under construction that will exceed 600 M in height. Understanding the energy and environment of these buildings is critical for their successes.

1. Energy and Environment of Super Tall Buildings

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

2. Variations and Influence of Ambient Conditions on Super Tall Buildings

Peter Simmonds, Ph.D., Fellow ASHRAE, Stantec, Sherman Oaks, CA

11:00 AM-12:30 PM

SEMINAR 41 (INTERMEDIATE)

Blue is the New Green: The Emerging Focus on Building Water Use Reduction

Track: Hydronic System Design

Room: Beekman

Sponsor: 02.08 Building Environmental Impacts and Sustainability

Chair: Andrew Price, P.E., Member, AEI, Madison, WI



Water is essential to the functioning of society. Its management has enormous financial, cultural, and environmental implications. The term "water: energy nexus" is used in reference to the interdependent and inseparable nature of the two. From the largest scale utilities to buildings, water use relies on energy, and the provision of energy engages significant water volumes. Similarly, conservation of one also limits demand for the other. In locations where water is a significant expense, we find that this cost, rather than that of energy, drives many design decisions. Until recently, water in its various classifications has been viewed in individual silos which limit the adoption of integrated solutions. The basic nature of our design teams tends to limit how we provide design solutions. Integrated solutions require stacking of benefits in order to achieve reasonable returns in competing with current technologies. The emerging concept of "net zero" will require that water is approached in a much different integrated fashion. This session explores innovative case studies that approach water in integrated solutions that cross professional practice areas.

1. Water at the Forefront: The Emerging Practice of Net Zero

Jeffrey Bruce, Jeffrey L Bruce & Company, North Kansas City, MO

2. Greywater Harvesting: The Falk Recreation Building Blue Roof, NYC

Paul Mankiewicz, Ph.D., Gaia Institute, New York, NY

3. Measuring the Cost Effectiveness of Water Use Reduction

Willa Kuh, Affiliated Engineers, Boston, MA

4. The Bigger Picture: The Value of Building Water Use Reduction to the New York City Region

Venetia Lannon, New York Department of Environmental Conservation, New York, NY

11:00 AM-12:30 PM

SEMINAR 42 (INTERMEDIATE)

Cooling Load Calculations for Radiant and Underfloor Air Distribution (UFAD) Systems: Are They the Same as Traditional Methods?

Track: Fundamentals and Applications

Room: Mercury

Sponsor: 04.01 Load Calculation Data and Procedures

Chair: Fred S. Bauman, P.E., Member, Center for the Built Environment, University of California, Berkeley, CA



The building industry is increasingly considering advanced, low-energy systems, such as radiant and underfloor air distribution (UFAD) systems. Under cooling operation, hydronic radiant systems remove heat by actively cooling exposed surfaces in the room, while UFAD systems generate thermal stratification with warmer temperatures near the ceiling and cooler temperature near the floor in the occupied zone. The radiant asymmetry and non-uniform temperature conditions established with these systems changes the heat transfer dynamics of the space. This seminar discusses how cooling load calculation methods for radiant and UFAD systems may differ from traditional methods used for well-mixed air distribution systems.

1. Design Zone Cooling Loads for Radiant Systems

Jingjuan Feng, Student Member, Fred S. Bauman, P.E., Member and Stefano Schiavon, Ph.D., Associate Member, University of California, Berkeley, CA

2. UFAD Cooling Load Design Tool

Stefano Schiavon, Ph.D., Associate Member, Fred S. Bauman, P.E., Member and Bin Chen, Student Member, University of California, Berkeley, CA

3. Design Process for Radiant Heating and Cooling Slab Systems

Daniel H. Nall, P.E., Member, Thornton Tomasetti Group, New York, NY

11:00 AM-12:30 PM

SEMINAR 43 (ADVANCED)

European Union: Practical Benchmarking of HVAC System Energy Efficiency

Track: International Design

Room: Sutton South

Sponsor: REHVA

Chair: Karel Kabele, Dr.Ing., President REHVA, Czech Technical University in Prague, Prague, Czech Republic

Systems used to condition and create indoor climate in buildings, including heating, ventilation and cooling, stand for more than one third of the energy consumption in developed countries, and this is where the energy savings are searched for in buildings. Since 2006, the European Energy Performance of Buildings Directive (EPBD-2002) has been implemented in building codes on a national level. For new and existing buildings, this requires a calculation of the energy performance of the building, including heating, ventilation, cooling, and lighting systems. It is, however, extremely important that the reduction in energy demand is made without reducing the indoor environmental quality (IEQ), because it will undermine the underlying need for healthy and safe living conditions indoors. This seminar is dedicated to explaining how information technologies and other tools are being used in Europe and by REHVA associated member countries to find the best compromises between HVAC systems, energy efficiency, and IEQ.

1. HVAC in Sustainable Office Buildings

Frank Hovorka, Service Développement Durable, Paris, France

2. Assessment of IEQ and Energy Efficiency in Buildings

Manuel Gameiro da Silva, Ph.D., Universidade de Coimbra - Pólo II, Coimbra, Portugal

3. The Practical Benchmarking of HVAC Systems Energy Efficiency in Use

Zoltan Magyar, Ph.D., Member, Budapest University of Technology and Economics, Budapest, Hungary

11:00 AM-12:30 PM

SEMINAR 44 (INTERMEDIATE)

Making Historic Buildings Sustainable

Track: Commissioning, Operation and Maintenance

Room: Rendezvous Trianon

Sponsor: Historical Committee, ASHRAE Associate Society Alliance

Chair: David Arnold, Ph.D., Fellow Life Member, London South Bank University, London, United Kingdom

Historic buildings, by definition, are buildings that have been around for a long time and likely to continue in use. Many were built 50 or more years ago and some retain their original mechanical systems. These systems were designed in an era when energy was abundant and thermal performance of the building fabric and energy use hardly considered. Making these buildings sustainable and reducing their energy use is often constrained by restrictions

on change to the external and sometimes internal appearance. This seminar includes four speakers with experience in transforming historic buildings to improve their sustainability.

1. Energy Efficiency in Historic Buildings

Tor Broström, Ph.D., University of Uppsala, Gotland, Visby, Sweden

2. 1913 Warehouse Transformed to a "Green Laboratory"

Pete King, King + King Architects, Syracuse, NY

3. United Nations Plaza: LEED Gold WSP

Gary Pomerantz, P.E., WSP, New York, NY

4. VCU Cary Street Gym: When Adaptive Reuse Means High Performance Building

Bryna Dunn, Moseley Architects, Richmond, VA

11:00 AM-1:00 PM

POSTER SESSION (INTERMEDIATE)

Track: Fundamentals and Applications

Room: Americas Hall 1



Presentation of ASHRAE Technical Papers by Poster. ASHRAE Conference Badge Required.

1. A Design Approach for Preventing and Solving Combustion

Oscillation Problems (RP-1517) (NY-14-023)

D. W. Herrin, Ph.D., P.E., Member, University of Kentucky, Lexington, KY

Combustion oscillations commonly occur in boilers, furnaces, and water heaters. At the present time, there is no systematic process for diagnosing the probable cause of an instability and solving the problem. Moreover, few design guidelines have been presented in the literature for avoiding thermo-acoustic instabilities before they occur. The current paper details steps that can be taken to prevent and diagnose combustion instabilities from the early stages of the design process through production.

2. Aerogel Thermal Insulation – Technology Review and Cost Study for Building Enclosure Applications (NY-14-024)

Nitin Shukla, Fraunhofer CSE, Cambridge, MA

Aerogels, due to their superior thermal insulating properties, are slowly and steadily finding application in the building industry. In this paper, first a review on the synthesis of aerogels is presented. Next, the theory behind the thermal transport in aerogels is described. Finally, the potential cost-effectiveness of aerogels as thermal insulation for internal wall retrofit applications is evaluated. Costs for several scenarios are estimated where aerogel blankets with different target R-values were installed from the interior of the building on top of the gypsum board.

3. An Actuarial Approach to Retrofit Savings in Buildings (NY-14-025)

Kris Subbarao, Ph.D., Member¹ and T. Agami Reddy, Ph.D., P.E., Fellow ASHRAE², (1)Pacific Northwest National Laboratory, Richland, WA, (2) Arizona State University, Tempe, AZ

An actuarial method has been developed for determining energy savings from retrofits from energy use data for a number of buildings. This method supports the U.S. Department of Energy Building Performance Database of real building performance data and related tools that enable engineering and financial practitioners to evaluate retrofits. The actuarial approach derives, from the database, probability density functions (PDFs) for energy savings from retrofits by creating peer groups for the user's pre post buildings.

4. Assessment of Airborne Endotoxin at the Air Exhaust of Swine and Poultry Confinement Buildings (NY-14-026)

Xufei Yang and Xinlei Wang, University of Illinois at Urbana-Champaign, Urbana, IL

Endotoxin has been widely recognized as an animal-production-related biological hazard and should ideally be removed from the exhaust air stream of an animal confinement building. In this study, PM10 and PM2.5 samples were seasonally collected at the air exhaust of 18 commercial animal confinement buildings (including tom turkey, laying hen, swine gestation, swine farrowing, swine weaning and swine finishing), and the PM10 and PM2.5 associated endotoxin levels were determined using a kinetic chromogenic *Limulus amoebocyte lysate (LAL)* assay.

5. Characteristics and Enhancement of a Disk Type Humidifier with Hydrophilic Rough Surface (NY-14-027)

Seongjin Yun¹, Youngjin Seo² and Byungryul Min¹, (1)Department of Chemical and Biomolecular Engineering, Yonsei University, Seoul, South Korea, (2)Kumoh National Institute of Technology, Gumi, South Korea

The performance of portable disk humidifiers relies on water vaporized into dry air. Among various kinds of humidifiers, a disk humidifier comprises of disks as a water vaporizing means. Water vaporizes naturally on the surfaces of disks into dry air which enters from a humidifier while air passes between spaces of disks. An experimental study was conducted to improve humidifier performance using three kinds of polymer disks: polypropylene (PP), acrylonitrile butadiene styrene (ABS), and compounded PP.

6. Demonstration with Energy and Daylighting Assessments of Thermo-chromic Window Systems (NY-14-028)

Xiaohui (Joe) Zhou¹ and Robert Milbrandt², (1)Iowa Energy Center, Ames, IA, (2)Iowa State University, Ames, IA

Thermo-chromic windows are a new type of fenestration that automatically change the solar transmission by a special thin-film laminated between two panes of glass. An empirical demonstration project was conducted to assess the annual building energy and daylighting performance of a thermo-chromic window model compared to a high-performance low-e dark tinted window model in a light commercial building environment that uses automatic dimming control under central Iowa weather conditions.

7. Development of 3,012 IWEC2 Weather Files for International Locations (RP-1477) (NY-14-029)

Joe Huang, Member, White Box Technologies, Moraga, CA

This paper announces the completion of a large new data set of International Weather for Energy Calculations 2 (IWEC2), i.e., "typical year", weather files for 3,012 locations outside of the U.S. and Canada, and describes the procedures used to produce these weather files, including how the raw weather data from the Integrated Surface Hourly (ISH) data base were processed, and how missing records and unrecorded climate parameters have been derived.

8. Exergy Analysis of a Gas Absorption Compression Cooler (NY-14-030)

Rajesh Kumar, Delhi Technological University, Delhi, India

This study investigates the utilization of low grade waste heat using a new cogeneration cycle for simultaneous production of heating and triple effect refrigeration. The proposed cogeneration cycle combines the low grade heat driven vapor absorption and ejector system for refrigeration and high grade energy driven cascaded system for producing heating and refrigeration. The LiBr-H₂O absorption system is employed to ejector which uses R141b for cooling and the cascaded system which uses CO₂ and N₂O as a working fluid for cooling and heating.

9. Energy Prediction of Electric Floor Radiation Systems using a New Integrated Modeling Approach (NY-14-031)

Ahmed Megri, University of Wyoming, Laramie, WY

This paper investigates the possibility of improving the heating energy demand calculation accuracy of a building equipped with an electric floor radiation system by the integration of a zonal model into a multi-room thermal model. Three thermostat set point strategies: Room Air Temperature, Mean Radiant Temperature, and Operative Temperature have been studied. Comparisons between the predictions of thermal multi-room model and the integrated zonal model POMA/multi-room model developed have been performed to demonstrate the importance of considering the room temperature distribution in energy predictions.

10. How Do Pressure Drop, Efficiency, Weight Gain and Loaded Dust Composition Change throughout Filter Lifetime? (RP-1360) (NY-14-032)

M. Kathleen Owen, RTI International, Research Triangle Park, NC

Research project 1360-RP investigated the nature of dust collected on general ventilation air filters and how the filter performance changes over time due at least in part to the collection of that dust. The project was undertaken with a two-pronged approach designed to maximize the information collected. The "Four-City Study" investigated the performance of in-situ filters over their lifetimes for pressure drop, dust weight gain and changes in filtration efficiency. To investigate the nature of dust collected by filters for a large number of locations, a "Multi-City Study" was undertaken.

11. Inter Unit Heat Flows in a Residence During District Heating in a Multistory Residential Building (NY-14-033)

Milorad Bojic, Member, University of Kragujevac, Kragujevac, Serbia

The paper presents investigations of space heating metering in a residence in a multistory residential building. The entire building is heated by a district heating system (DHS). The residence may be heated by DHS and/or electrical

energy. The analyzed residence may be either the non-excluded or excluded from DHS. The residence has a low heat demand compared to the average heat demand of all DHS consumers. Space heating is simulated by using software EnergyPlus during the 6-month heating season with a weather file of Kragujevac, Serbia.

12. Method of Effectiveness Evaluation of Control Modes for Centrifugal Pumps with Variable Speed Motors (NY-14-034)

Deniss Pilscikovs, Ph.D., Riga Technical University, Riga, Latvia

This paper describes a portion of a study, which investigated the reduction of energy consumption in grocery stores in a hot and humid climate. The first part of the study investigated the maximum possible savings that can be obtained on implementing energy efficiency measures in a grocery store. The second part of the study took a step further and examined the option of combined heat and power (CHP) technologies to power the grocery store and a portion of the community to further reduce the energy consumption of the grocery store and the community. In this paper, several energy efficiency measures (EEMs) for the grocery store were examined to reduce the overall energy consumption of the store.

13. Optimal Control of Energy Recovery Ventilators during Cooling Season (NY-14-035)

Mohammad Rasouli, AL

Concern over providing acceptable Indoor Air Quality (IAQ) while minimizing associated energy consumption has raised attentions towards optimizing HVAC equipment. Energy Recovery Ventilators (ERVs) transfer energy between conditioned exhaust air and outdoor ventilation air to reduce the energy demand of HVAC system. An ERV may operate in (i) full-load, (ii) part-load or (iii) full bypass (no energy transfer) condition. In this paper, based on minimization of HVAC system energy consumption, an optimal strategy to control the operation of an ERV is concluded and compared to other control alternatives in the literature.

14. Predicting Annual Energy Use in Buildings Using Short-Term Monitoring: The Dry Bulb Temperature Analysis (DBTA) Method (NY-14-036)

T. Agami Reddy, Ph.D., P.E., Fellow ASHRAE¹ and Vipul Singh, Student Member¹, (1)The Design School/The School of Sustainable Engineering and the Built Environment, Tempe, AZ

This paper summarizes findings of a recently completed ASHRAE research project (RP-1404) meant to develop and assess methods by which short-term in-situ monitoring of building energy use can be used as a workable alternative in yearlong monitoring and verification (M&V) projects. A new and simple approach, called the Dry Bulb Temperature Analysis (DBTA) method, is proposed which, based on dry-bulb ambient temperature data alone, allows one to design a sound short-term monitoring protocol for verifying annual savings from M&V projects.

15. R410A Maldistribution Impact on the Performance of Microchannel Evaporator (NY-14-037)

Yang Zou, University of Illinois at Urbana-Champaign, Urbana, IL

R410A upward flow in a transparent vertical header of microchannel heat exchanger (MCHX) was investigated experimentally to explore the effects of refrigerant maldistribution on the MCHX performance. Refrigerant was provided into the transparent header by five tubes in the bottom pass and exits through the five tubes in the top pass. It represents the flow in the outdoor heat exchanger (usually used as the condenser) when it is used as the evaporator in the heat pump mode of reversible systems.

16. Reducing Energy Consumption in Grocery Stores: Energy Efficiency Measures for Grocery Stores (NY-14-038)

Jaya Mukhopadhyay, Student Member, Texas A&M University, College Station, TX

The first part of the study investigated the maximum possible savings that can be obtained on implementing energy efficiency measures in a grocery store. The second part of the study took a step further and examined the option of combined heat and power (CHP) technologies to power the grocery store and a portion of the community to further reduce the energy consumption of the grocery store and the community. In this paper, several energy efficiency measures (EEMs) for the grocery store were examined to reduce the overall energy consumption of the store. A calibrated whole-building energy simulation program was used to carry out this analysis.

17. Study of Input Parameters for Risk Assessment of 2L Flammable Refrigerants in Residential Air Conditioning and Commercial Refrigeration Applications (RP-1580) (NY-14-039)

William Goetzler, Member and Javier Burgos, Associate Member, Navigant, Burlington, MA

Comprehensive risk assessments of 2L refrigerants are needed to evaluate the use of alternative refrigerants in stationary HVAC and refrigeration applications. This study uses CFD simulations, concentration mapping tests, and ignition tests to determine which leak scenarios for HFC-32 and HFO-1234yf may result in flammable concentrations. We simulated 17 different residential and light commercial leak scenarios, and selected six distinct scenarios for ignition testing. In the future, the data should be combined with additional field studies to conduct full risk assessments of HVAC and refrigeration equipment.

18. The Formation and Runoff of Condensate on a Vertical Glass Surface (NY-14-040)

John Wright, Member, University of Waterloo, Waterloo, ON, Canada

An experimental study of condensate formation and runoff was performed by exposing a sheet of glass, cooled at its bottom edge, to an enclosure with a controlled environment. This arrangement mimics the indoor glass surface at the bottom edge of a window when the window is exposed to a cold outdoor environment. Measurement results were used to produce a summary plot showing runoff front position as a function of glass surface temperature and RH. This chart can be used to predict the runoff front progression at the bottom edge of any window if the surface temperature profile is known.

1:30 PM-3:00 PM

SEMINAR 45 (ADVANCED)

Life Safety Issues with Tall Buildings

Track: Tall Buildings: Performance Meets Policy

Room: Trianon

Sponsor: 09.12 Tall Buildings, 05.06 Control of Fire and Smoke

Chair: William A. Webb, P.E., Fellow ASHRAE, WEBB FIRE Protection Consulting, LLC, Brooksville, FL

The seminar discusses the challenges of providing elevator pressurization in tall buildings. ASHRAE TC 9.12 defines a Tall Building as at least 300 feet tall. The background and outline of code requirements, for the systems are presented by one speaker. Another speaker describes design features including calculation means for pressurization airflow and pressure differential. This speaker also describes the challenges in achieving these values while allowing the elevator to operate. The final speaker presents a case study and lessons learned.

1. Design Features of Pressurization Airflow and Pressure Differential

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

2. Codes and Standards

Jeffrey Tubbs, P.E., Member, Arup, Cambridge, MA

3. Case Study

Steven M. Strege, P.E., Member, Hughes Associates, Inc., Baltimore, MD



2:00 PM-3:00 PM

SEMINAR (ADVANCED)

Lubricants Optimized for use with Low Global Warming Potential Refrigerants

Track: Systems and Equipment

Room: Petit Trianon

Sponsor: 03.04 Lubrication, MTG.LowGWP Alternative Lower Global Warming Potential Refrigerants

Chair: Scott R. Gustafson, Member, Shrieve Chemical Products, Inc., The Woodlands, TX

OPEN SESSION: no badge required; no PDHs awarded; presented during the TC's meeting. Lubricants are necessary in refrigeration and AC systems for proper lubrication of the compressor and components, sealing clearances and removing heat. Low GWP refrigerants being implemented in next generation systems include hydrocarbons, CO₂, unsaturated hydrofluorocarbons



(HFOs), R-32 and HFC/HFO blends. New lubricants may be needed to ensure proper system performance and reliability. Significant energy savings can be achieved by optimizing lubricant/refrigerant solution properties to provide the best balance of lubrication in the compressor and excellent heat transfer in the refrigeration cycle. This seminar will present how lubricant selection can impact the performance of refrigeration and AC systems using low GWP refrigerants. Presentations include "Help, I Need a Lubricant for My Lower GWP Refrigerant" by Joseph A. Karnaz, Member, of CPI Engineering/Lubrizol in Midland, MI; "Polyol Ester Lubricants Designed for Use with R-32 and Related Low GWP Refrigerant Blends" by Edward Hessel, Ph.D., Member, of Chemtura Corporation in Middlebury, CT; "Properties of the New PVE Lubricant For Air Conditioning System" by Eric Schweim, Member, of Idemitsu Lubricants America in Southfield, IL.

3:00 PM-4:00 PM

Javits Convention Center
South Concourse, 2nd Level

AHR EXPO SESSION 1 (ADVANCED)

Trends in Building Energy Disclosure: Increasing Energy Efficiency without Retrofits

Track: Tall Buildings: Performance Meets Policy

Sponsor: 07.09 Building Commissioning

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

Energy efficiency has traditionally been achieved through physical retrofits, but in this seminar, an alternative approach is presented that harnesses data from smart meters and provides feedback to building occupants on their energy consumption. This seminar highlights the growing trend in energy disclosure policies and presents a new energy benchmarking model to support comparative energy performance evaluation across commercial buildings. This study analyzes patterns of energy consumption across New York City buildings and models the determinants of building energy efficiency.

1. Building a Better Benchmark: Lessons From New York City's Local Law 84 Energy Disclosure Data

Constantine Kontokosta, Ph.D., P.E., NYU Center for Urban Science and Progress, New York, NY

2. Encouraging Energy Efficient Behavior Of Building Occupants Through Contextualized Feedback and Social Network Dynamics

Rishee Jain, Ph.D., NYU Center for Urban Science and Progress, Brooklyn, NY



3:15 PM-4:45 PM

SEMINAR 46 (ADVANCED)

Natural Ventilation for Tall Buildings

Track: Tall Buildings: Performance Meets Policy

Room: Trianon

Sponsor: 09.12 Tall Buildings

Chair: Andrew Reilman, P.E., Member, Syska Hennessy Group, Culver City, CA

This seminar presents the practicalities of designing and applying natural ventilation for tall building and describes how weather modeling can be used to generate climate data and then in turn how it is used for building energy analysis. The weather tool is described, and then several case studies are presented that demonstrate the value of this approach. The case studies include different climates and different building heights and include the application of natural ventilation, controversial for most buildings. Results of studies made for adaptive comfort conditions in mega and super tall buildings are presented.

1. Ambient Conditions

Duncan Phillips, Rowan Williams Davies & Irwin, Guelph, ON, Canada

2. Application of Natural Ventilation

Peter Simmonds, Ph.D., Fellow ASHRAE, Stantec, Sherman Oaks, CA



3:30 PM-4:30 PM

SEMINAR (INTERMEDIATE)

Performance of Non-Western Clothing: Expanding ASHRAE's Database

Track: Indoor Environmental Health/Indoor Environmental Quality

Room: Beekman

Sponsor: 02.01 Physiology and Human Environment

Chair: Dennis L. Loveday, Ph.D., Member, Loughborough University, Loughborough, United Kingdom

OPEN SESSION: no badge required; no PDHs awarded; presented during the TC's meeting. Clothing insulation values are an essential component for the prediction of human thermal comfort sensations, and are critical to energy-efficient design. To date, ASHRAE Standard 55 provides data that are largely relevant to Western-style clothing ensembles. To help ensure the continuing relevance of ASHRAE Standards and design guidance for other global regions, this seminar presents new data on thermal insulation values for non-Western clothing ensembles for a range of conditions, postures and airspeeds, together with examples of use. ASHRAE-funded Research Project 1504 was a contributor to these new data.

Wednesday, January 22

8:00 AM-9:30 AM

CONFERENCE PAPER SESSION 21 (INTERMEDIATE)

Hydronic System Efficiencies and Chilled Water System Controls

Track: Hydronic System Design

Room: Beekman

Chair: David S. Eldridge, P.E., Member, Grumman Butkus Associates, Evanston, IL



Three papers address the energy efficiency of hydronic systems – one through the analysis of the actuator position, another on a study of failed performance testing of pump models, and a third on modeling using a spreadsheet method. Two papers present a new control algorithm for a primary chilled water system that is more energy efficient, gives the desired control performance and results in increased control stability.

1. Energy Efficiency Strategies for Hydronic Systems Through Intelligent Actuators (NY-14-C073)

Marc Thuillard, Ph.D.¹, Forest Reider¹ and Gregor Henze, Ph.D., P.E., Member², (1)Belimo Automation AG, Hinwil, Switzerland, (2)University of Colorado, Boulder, CO

2. Towards the ASHRAE 2020 Vision with an Efficiency Increase to a Pump Product Range (NY-14-C074)

Greg Towsley, Member¹ and Stuart Bloomfield², (1)Grundfos, Olathe, KS, (2)Grundfos CBS Inc., Brookshire, TX

3. Hydronic System Modeling: A Spreadsheet Approach (NY-14-C075)

Robert Polchinski, P.E., Member, New York City College of Technology, Brooklyn, NY

4. Primary Chilled Water System Control Optimization Integrated with Secondary System Linearization, Part 1: Theoretical Analysis and Simulation (NY-14-C076)

Lixia Wu, Ph.D., Member¹ and Mingsheng Liu, Ph.D., P.E., Member², (1)Bes-Tech, Inc., Philadelphia, PA, (2)Bes-Tech, Inc., Omaha, NE

5. Primary Chilled Water System Control Optimization Integrated with Secondary System Linearization, Part 2: Field Investigation (NY-14-C077)

Lixia Wu, Ph.D., Member¹ and Mingsheng Liu, Ph.D., P.E., Member², (1)Bes-Tech, Inc., Philadelphia, PA, (2)Bes-Tech, Inc., Omaha, NE

8:00 AM-9:30 AM

CONFERENCE PAPER SESSION 22 (INTERMEDIATE)

Optimum Design of Heat Exchangers

Track: Systems and Equipment

Room: Sutton South

Chair: Samir Traboulsi, Ph.D., P.E., Member, Thermotrade/Ranec, Beirut, Lebanon



Optimum performance and energy conservation are becoming the main challenged focus of designers and researchers. The Design schemes of Compact Phase Change Based Thermal Stores, Hybrid Air Conditioners for Hot and Humid Climates, Dehumidifying Heat Exchangers, Earth-Air Heat Exchangers in two burying modes and the Air Bearing Heat Exchanger, whether based on numerical methods, experimental or other modeling and simulation systems, or whether it is an innovation or improvement illustrates such attitude.

1. Compact Phase Change Based Thermal Stores: Experimental Apparatus, Methodology, and Results (NY-14-C078)

Stephen Bourne, Student Member and Atila Novoselac, Ph.D., Associate Member², University of Texas, Austin, TX

2. Experimental Investigation of a Hybrid Air Conditioner for Hot and Humid Climates (NY-14-C079)

Ali Al-Alili, Ph.D., Student Member¹, Yunho Hwang, Ph.D., Member² and Reinhard Radermacher, Ph.D., P.E., Fellow ASHRAE², (1)The Petroleum Institute, Abu Dhabi, United Arab Emirates, (2)University of Maryland, College Park, MD

3. The Impact of Fin Surface Wettability on the Performance of Dehumidifying Heat Exchangers (NY-14-C080)

Liping Liu, Ph.D., Associate Member¹ and Anthony M. Jacobi, Ph.D., Fellow ASHRAE², (1)Lawrence Technological University, Southfield, MI, (2)University of Illinois at Urbana-Champaign, Urbana, IL

4. In Situ Testing of Earth-Air Heat Exchangers: Under Slab vs. Under Yard (NY-14-C081)

Kevin L. Amende, P.E., Associate Member and Chantz M. Denowh, Student Member, Montana State University, Bozeman, MT

5. Heat Transfer and Pressure Drop Performance of the Air Bearing Heat Exchanger (NY-14-C082)

Wayne L. Staats, Ph.D., Affiliate, N.D. Matthew, Ethan S. Hecht, Ph.D., Terry A. Johnson and Jeff Koplou, Ph.D., Sandia National Laboratories, Livermore, CA

8:00 AM-9:30 AM

SEMINAR 47 (INTERMEDIATE)

A Look at DCIM Solutions and Their Integration Challenges in Today's Data Centers and a Look at What Tomorrow Offers

Track: Fundamentals and Applications

Room: Trianon

Sponsor: 09.09 Mission Critical Facilities, Technology Spaces and Electronic Equipment

Chair: Nick Gangemi, Member, Facility Gateway Construction, Madison, WI



Today's control systems have gotten far more complicated than they were just 5 to 10 years ago. The integration of internet based software solutions for GUT's, analytics, and web applications using TCP/IP based protocols, combined with traditional building control systems based on ASHRAE Standard 135 (BACNET), Modbus, Lonworks, etc, has created a complex maze of integration issues for vendors, designers, and end-users alike. Most recently DCIM or Data Center Infrastructure Management software solutions have also become widely popular. These solutions suffer from the same integration challenges of IT and facilities based control systems. This workgroup examines a major control change to improve the performance of an active data center in a high rise building, a couple of perspectives related to today's DCIM, IT software, and traditional BMS control systems and a look to what the future might hold.

1. Integration Challenges and End User Expectations

David Quirk, P.E., Member, Tieche Engineered Systems, Woodland, CA

2. Challenges with Multi-industry Protocols and Future Considerations

Don Beaty, P.E., Member, DLB Associates, Eatontown, NJ

3. Case Study of a Major Control Change within an Operating Data Center in a High Rise Building

Jack Glass, Member, Citi Corp, New York, NY

8:00 AM-9:30 AM

SEMINAR 48 (BASIC)

App, App and Away: Enabling Meaningful Work for the Building Professional with the Development of Quality Apps for Smartphones and Tablet Computers

Track: Building Information Systems

Room: Mercury

Sponsor: 01.05 Computer Applications, Publications Committee

Chair: Tim Dwyer, Fellow ASHRAE, Bartlett School of Graduate Studies, University College London, London, United Kingdom

There are literally millions of apps available for smartphones and tablet computers. Identifying useful apps is increasingly challenging, leading to many exploring the development of truly useful apps for the professional building practitioner. This session explores the evolution of apps; the methods for developing and establishing a reliable app to provide an accessible and verifiable way for building professional to solve practical problems; examines the state of in-house and publicly available HVAC&R related apps – including the ASHRAE apps - and how those are brought to market; and finally looks at areas of potential app development.

1. The Current State of Mobile Apps for HVAC

Stephen Roth, P.E., Member, Carmel Software Corp., San Rafael, CA

2. Software Development Process for Smart Device Applications

Richard Szydlowski, Center for Energy and Environment, Minneapolis, MN

3. Applying Applications

Sara R. Tepper, Student Member¹ and Alison G. Kwok, Ph.D., Member²,
(1)University of California Berkeley, Berkeley, CA, (2)University of Oregon,
Eugene, OR

8:00 AM-9:30 AM

SEMINAR 49 (INTERMEDIATE)

Are Renewable Resources Renewable Energy? A Life Cycle Assessment Perspective

Track: Fundamentals and Applications

Room: Sutton North

Sponsor: 02.08 Building Environmental Impacts and Sustainability

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

This seminar reviews and provides different viewpoints on renewable resources when used to provide energy to a building. It distinguishes among different renewable resources, such as wind, hydro, solar, and biomass using life cycle assessment methodology. Different definitions and applications of renewable resources to displace fossil fuels are provided. The seminar also includes a panel discussion on the issue of biomass and other renewable resources when used to meet building energy requirements.

1. The Fallacy of Bio-Based Materials: A Life Cycle Approach

Rita C. Schenck, Ph.D., Institute for Environmental Research & Education, Vashon, WA

2. Forest Biomass: An Important but Often Misunderstood Renewable Resource

Reid Miner, P.E., NCASI, Research Triangle Park, NC

3. Renewable Resources are Different from Renewable Energy

Martha G. VanGeem, P.E., Member, Self-Employed, Mount Prospect, IL

8:00 AM-9:30 AM

SEMINAR 50 (BASIC)

Developments in Refrigerator Standards

Track: Refrigeration

Room: Regent

Sponsor: 08.09 Residential Refrigerators and Food Freezers

Chair: Detlef Westphalen, Ph.D., Member, Navigant Consulting, Inc., Burlington, MA

2014 is a significant year for refrigerator standards. New U.S. Department of Energy (DOE) efficiency standards take effect on September 15. At the same time, new DOE test procedures will be required for demonstrating compliance with the standards. DOE has developed these rules with a backdrop of simultaneous work by the International Electrotechnical Commission (IEC) to update its Standard 62552, "Household Refrigerating Appliances—Characteristics and Test Methods", and by Underwriters Laboratories on updating its Standard 250 for household refrigerators and freezers. This session discusses all of these developments.

1. Changes in UL 250, Safety Standard for Household Refrigerators and Freezers

Randall J. Haseman, P.E., Member, Underwriters Laboratories, Northbrook, IL

2. Changes in DOE Test Procedures for Residential Refrigerators in 2014

Detlef Westphalen, Ph.D., Member, Navigant Consulting, Inc., Burlington, MA

3. Residential Refrigerator 2014 Energy Efficiency Standards: Product and Market Impacts

Gregory Rosenquist, Member, Lawrence Berkeley National Laboratory, Berkeley, CA

8:00 AM-9:30 AM

SEMINAR 51 (INTERMEDIATE)

DOE's Building Energy Efficient Buildings Hub's Findings and the Future of Equipment and System Design Applied to Building Retrofits

Track: Commissioning, Operation and Maintenance

Room: Rendezvous Trianon

Sponsor: 07.01 Integrated Building Design

Chair: Gregory Dobbs, Ph.D., Member, Pennsylvania State University, Philadelphia, PA

DOE's Building Energy Efficient Buildings Hub has been studying the future of equipment and system design applied to building retrofits for the past three years. This seminar presents the EEB Hub's findings and provides further details on two important areas of interest. The first presentation explains the impact on integrated system design of cost effective lighting/shading retrofits. The second presentation is an initial assessment of the City of Philadelphia's benchmarking and disclosure ordinance data and implications for future energy retrofit design.

1. EEB Hub Findings and their Impact on Equipment and Systems Designs for Retrofits

Timothy Wagner, Ph.D., Member, United Technologies Research Center, East Hartford, CT

2. EEB Hub Detailed Findings: Lighting/Shading Impact on Systems Retrofit Design

Athanasios Tzempelikos, Associate Member, Purdue University, West Lafayette, IN

3. EEB Hub Detailed Findings: Initial 2012 Data Analysis and Design Implications of Philadelphia's Benchmarking and Disclosure Ordinance

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



8:00 AM-9:30 AM

SEMINAR 52 (INTERMEDIATE)

How Much Energy Saving can we Expect from Natural Ventilation?

Track: *Systems and Equipment*

Room: *Sutton Center*

Sponsor: **04.07 Energy Calculations, 04.10 Indoor Environmental Modeling**

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

Natural ventilation is considered to be an effective approach to reduce building consumption. However, the performance of natural ventilation system varies depending on the location, weather condition, building geometry and many other factors. As a result, the decision of selecting natural ventilation can be challenging. Computer tools have been used for the design and performance evaluation of natural ventilation in buildings. This seminar introduces some cutting edge techniques and case studies for the design and performance valuation of natural ventilation system.

1. Natural Ventilation Renovations in California: Estimating the Technical Potential using Whole Building Energy Software

Samuel. L Brunswick and Philip Hayes, Lawrence Berkeley National Laboratory, Berkeley, CA

2. Software Tools to Aid in the Design of Natural Ventilation Systems

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

3. Estimating the Energy Savings of Hybrid Natural Ventilation/Air Conditioning Systems

Leon Glicksman, Massachusetts Institute of Technology, Cambridge, MA



9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 23 (INTERMEDIATE)

Performance of Roof Top Units and Centrifugal Fans

Track: *Systems and Equipment*

Room: *Regent*

Chair: *Wei Zhang, Boeing Commercial Airplanes, Seattle, WA*



The performance and advances of RTUs are described in two papers. The papers address the gas-fired, condensing RTU, evaluating its performance through a field test in one paper and through field monitoring in another. A third paper describes the process of utilizing impeller replacement to upgrade centrifugal fan performance, exploring identification of the upgrade through installation and fan commissioning.

1. Evaluating the Performance of a Condensing Roof Top Unit (RTU) in a Small Office Application (NY-14-C083)

Martin Thomas, P.Eng., Member, A.C.S (Skip) Hayden, P.Eng. and Bryan Halliday, P.Eng., Member, RIES, CanmetENERGY, Natural Resources Canada, Ottawa, ON, Canada

2. Field Monitoring of Rooftop Unit (RTU) Heating Runtimes and Gas Usage for Selected Commercial Buildings (NY-14-C084)

Douglas Kosar, Member, Shawn Scott, Hillary Vadnal, Associate Member and Paul Glanville, P.E., Associate Member, Gas Technology Institute, Des Plaines, IL

3. Upgrading Performance of Centrifugal Fans with an Impeller Replacement (NY-14-C085)

Robert Z. Smith, Member, Innerquest LLC, Dowagiac, MI

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 24 (INTERMEDIATE)

Radiant Cooling System Opportunities

Track: *Fundamentals and Applications*

Room: *Sutton Center*

Chair: *Peter Simmonds, Ph.D., Fellow ASHRAE, Stantec, Sherman Oaks, CA*



This session presents three papers that identify recent experiences in developing a new methodology on radiant cooling systems, thermal comfort in a hydronic radiant panel system and a comparison of thermal environmental conditions in a radiant ceiling and wall panel system for heating.

1. The Influence on Surface Coverings on the Performance of Radiant Floors for Both Heating and Cooling (NY-14-C086)

Peter Simmonds, Ph.D., Fellow ASHRAE, Stantec, Sherman Oaks, CA

2. Experiences on Radiant Cooling Technology in Latin America Country – Mexico (NY-14-C087)

Eric F. Hernandez, P.E., Associate Member, KE Fibertec Mexico, Mexico, Mexico

3. Comparative Analysis of Thermal Comfort in a Hydronic Radiant Ceiling and Wall Panel System for Heating in South Korea (NY-14-C088)

Sung-Im Kim¹, Jae-han Lim, Ph.D.¹, Seung-Yeong Song, Ph.D.¹, Yong-woon Lee² and Kwang Woo Kim, P.Eng.³, (1)Ewha Womans University, Seoul, South Korea, (2)Building & Environment Co., Ltd., Seoul, South Korea, (3)Seoul National University, Seoul, South Korea

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 25 (INTERMEDIATE)

Modelling Thermal Components of Buildings

Track: *Fundamentals and Applications*

Room: *Sutton South*

Chair: *Dan Fisher, Oklahoma State University, Stillwater, OK*



Building energy simulation programs require accurate thermal component models. This session presents recent advances in the development and analysis of thermal component models for building energy analysis including dynamic shading, pipe insulation and sensitivity analysis models.

1. Daylighting and Thermal Assessment of Combined Dynamic Shading Systems on Energy Consumption in Educational Buildings (NY-14-C089)

Sagar Rao, Associate Member¹ and Athanasios Tzempelikos, Associate Member², (1)Affiliated Engineers, Inc., Madison, WI, (2)Purdue University, West Lafayette, IN

9:45 AM-10:45 AM

TECHNICAL PAPER SESSION 9

Advances in Measurement and Modeling of Indoor Environmental Quality of Animal Buildings

Track: *Fundamentals and Applications*

Room: *Beekman*

Sponsor: **02.02 Plant and Animal Environment**

Chair: *J. Patrick Carpenter, P.E., Member, Facility Performance Engineers, Cinnaminson, NJ*



Concentrated, large-scale animal feeding operations create significant challenges in controlling air emissions and maintaining indoor environmental quality. Many ASHRAE members are involved in design and troubleshooting of environmental quality systems for animal facilities, and research developments in these areas have been ongoing efforts. This technical paper session, sponsored by ASHRAE TC2.2 Plant and Animal Environment, includes papers related to advances in measurement, modeling, and mitigation technologies for indoor environmental quality of animal facilities.

1. Quantification of Ventilation Effectiveness for Air Quality Control in Animal Buildings (NY-14-042)

Sheryll Jerez, Stephen F. Austin State University, Nacogdoches, TX

2. Heat and Moisture Production of Modern Swine (NY-14-043)

Tami M. Brown-Brandl, Ph.D., Associate Member, USDA-ARS-MARC, Clay Center, NE, NE

3. An Optimized Electrostatic Precipitator for Air Cleaning of Particulate Emissions from Poultry Facilities (NY-14-044)

Roderick Manuzon, Ph.D., Student Member, Lingying Zhao, Ph.D., Member and Christopher Gecik, The Ohio State University, Columbus, OH

2. An Experimentally Validated Model to Predict the Thermal Conductivity of Closed-Cell Pipe Insulation Systems with Moisture Ingress

Shanshan Cai, Student Member and Lorenzo Cremaschi, Ph.D., Member, Oklahoma State University, Stillwater, OK

3. A Sensitivity Analysis of Energy Simulation Accuracy for a Renovated Healthcare Building (NY-14-C091)

Ibrahim W. Alanqar, Student Member, Mohammad Heidarinejad and Dr. Jelena Srebric, Member, Pennsylvania State University, State College, PA

9:45 AM-10:45 AM

CONFERENCE PAPER SESSION 26 (INTERMEDIATE)

Data Center Control and Fire Safety in Tall Buildings

Track: Systems and Equipment

Room: Mercury

Chair: Bill Dietrich, Member, Daikin Applied, Staunton, VA



Concerns have been raised about the adequacy of fire safety provisions in very tall buildings. Few comprehensive studies have been reported on the dynamics of room fires in such buildings. One paper will discuss hazards encountered in a very tall building fire. The following two papers discuss different aspects of Data Center control, from focusing on air movement in the center to worldwide control strategies.

1. Fire Safety Concern for Supertall Buildings (NY-14-C092)

W.K. Chow, Ph.D., Member, The Hong Kong Polytechnic University, Hong Kong, Hong Kong

2. Analysis of Air Leakage From Hot Aisle Containment Systems and Cooling Efficiency of Data Centers (NY-14-C093)

Kishor Khankari, Ph.D., Member, AnSight LLC, Ann Arbor, MI

3. Control Strategies for Data Centers: Trends Around the Globe (NY-14-C094)

Daniel S. Hallett, Arup, New York, NY

9:45 AM-10:45 AM

SEMINAR 53 (BASIC)

Hospital Building Performance: More for Less

Track: Fundamentals and Applications

Room: Trianon

Sponsor: 09.06 Healthcare Facilities

Chair: Michael Meteyer, P.E., Member, ERDMAN Company, Madison, WI

Hospital facilities provide a unique environment that must support the health care functions focused on delivering positive patient outcomes. As a result, the definition of high performance includes the special IEQ functions along with a priority on reliability, ease of service and maintenance. In addition to these priorities, the building systems must also do so using less energy! Come to the presentation to find out actual examples and experience on how some hospitals are making that happen.

1. Case Study : SUNY New Hospital Project Reducing Energy By +25% Using Advanced Commissioning Techniques

Ronald L. Westbrook, P.E., Member, State University of New York, Upstate Medical University, Syracuse, NY

2. Acceptance and Testing For Operations and Maintenance Turnover

Paul Raschilla, Member, AKF Group, New York, NY



9:45 AM-10:45 AM

SEMINAR 54 (INTERMEDIATE)

HVAC&R Paper Seminar: RP-1353 Stability and Accuracy of VAV Box Control at Low Flows

Track: Systems and Equipment

Room: Rendezvous Trianon

Sponsor: 01.04 Control Theory and Application

Chair: Jin Wen, Drexel University, Philadelphia, PA



This seminar presents the research findings from Research Project 1353 (sponsored by TC 1.4). This research project aims at identifying the major factors that cause the airflow measurement in a variable air volume (VAV) system to be inaccurate and unstable, especially at low airflow conditions. VAV systems with direct digital controllers (DDC) have been widely adopted

in HVAC system of commercial, industrial, and large residential buildings, because they provide better energy efficiency and occupant comfort. However, it has been found that the VAV terminal units often fail to perform as expected at the minimum airflow ranges (below 500 fpm). This problem results in a series of problems including a lack of ventilation, uneven control of airflow, reduced damper and operator life, and energy waste. Major factors that cause these inaccuracy and instability issues, and the relationship between the strong factors and the performance of the airflow sensor, controller, and terminal unit system are examined in this project through systematically designed laboratory and field tests.

1. Stability and Accuracy of VAV Box Control at Low Flows:

Laboratory Test Setup and VAV Sensor Test

Ran Liu, Ph.D., Student Member, Iowa Energy Center, Ankeny, IA

2. Stability and Accuracy of VAV Box Control at Low Flows:

Controller Test, System Test, and Field Test

Ran Liu, Ph.D., Student Member, Iowa Energy Center, Ankeny, IA

9:45 AM-10:45 AM

FORUM 1 (INTERMEDIATE)

Value for Smart Meters for Building Operation and Consumers

Track: Building Information Systems

Room: Sutton North

Sponsor: 07.05 Smart Building Systems

Chair: J. Carlos Haiad, P.E., Member, Southern California Edison, Irwindale, CA

Smart meters are a key element of the smart grid by providing a better connection to consumers and to their energy usage information. As of today, 45 million smart meters have been deployed by utilities across the USA. Energy efficiency standards in a few states and leading professional organizations are starting to expect building designers to take into consideration how building systems can leverage the connection and information from the smart meters. The forum discusses and seeks input in the impact of the smart meter on: building design and commissioning, energy management and control, and operational strategies and costs.

11:00 AM-12:30 PM

SEMINAR 55 (INTERMEDIATE)

Application of Dynamic Optimization to Smart Building Systems

Track: Fundamentals and Applications

Room: Beekman

Sponsor: TGI Optimization

Chair: Christopher Laughman, Ph.D., Associate Member, Mitsubishi Electric Research Laboratories, Cambridge, MA

Smart building systems hold much promise on the path to creating high performance buildings, but maintaining that performance over years and through changes in building occupancy and utilization can be a major challenge. The use of optimization methods that can compensate for the effect of time-varying conditions in these smart building systems is one important way that the performance of a building can be maintained at a high level over the building's lifetime. This seminar reviews the use of these techniques in both the creation of control strategies, as well as in the online control of building energy systems.

1. Initial Exploration of Demand Responsive Cooling with TABS

Alex Niswander and P.R. Armstrong, Ph.D., Member, Masdar Institute of Science and Technology, Abu Dhabi, United Arab Emirates

2. Assessment of Alternative Approaches for Model Predictive Control in Multi-Zone Buildings

James Braun, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN

3. Simulation and Optimization Based Derivation of Simple Controllers for Building Systems

Brian Coffey, Ph.D., Lawrence Berkeley National Laboratories, Berkeley, CA

4. Development of a Control Strategy with Multiple Continuous Outputs

Kyle Gluesenkamp, Ph.D., Student Member¹ and Vikrant Aute, Ph.D., Member², (1)Oak Ridge National Laboratories, Knoxville, TN, (2)University of Maryland, College Park, MD



11:00 AM-12:30 PM

SEMINAR 56 (INTERMEDIATE)

Impact of Unvented Combustion on Indoor Air Quality

Track: *Indoor Environmental Health/*

Indoor Environmental Quality

Room: *Sutton Center*

Sponsor: *SSPC 62.2, Environmental Health Committee*

Chair: *David Delaquila, Member, AHRI, Arlington, VA*



As new home construction methods and weatherization programs strive to tighten the building envelope to conserve energy, concerns for achieving acceptable indoor air quality (IAQ) continue to be an important topic of discussion and debate. Emissions from the use of unvented combustion space heating and cooking appliances are a few of the top concerns for impacting acceptable IAQ. This seminar seeks to present the results from relevant research and offer the perspective from both advocates and critics alike.

1. Product Safety and IAQ from Industry Experience

Donald W. Denton, Vent-Free Gas Products Alliance Section of AHRI, Townsend, TN

2. Indoor Pollutant Concentrations from Using Unvented Space Heaters

Paul W. Francisco, Member, University of Illinois, Champaign, IL

3. Ventilating Combustion Indoors? Why and How We Should

Shelly L. Miller, Ph.D., Member, University of Colorado, Boulder, CO

4. Impact of Vent-Free Gas Heater on IAQ from a Toxicologist's Perspective

Gary K. Whitmyre, toXel, LLC, Gainesville, VA

11:00 AM-12:30 PM

SEMINAR 57 (INTERMEDIATE)

Lessons Learned from Storm Recovery

Track: *Indoor Environmental Health/*

Indoor Environmental Quality

Room: *Sutton North*

Sponsor: *01.12 Moisture Management in Buildings*

Chair: *Low Harriman III, Fellow ASHRAE, Mason Grant, Portsmouth, NH*



The persistent and excessive dampness from floods and hurricanes creates severe indoor air quality problems and sometimes health risks for building owners and occupants. To reduce such risks, architects and engineers in New York City share valuable and hard-learned lessons from the difficult recovery from Hurricane Sandy. Experts in other climate zones share equally useful lessons from recovering from tropical storms. These presentations provide practical, actionable suggestions specific to New York City, as well as suggestions learned that are applicable to other coastal storm regions.

1. NYC Code Changes Based on Lessons Learned from Hurricane Sandy

Mark Ginsberg, Curtis & Ginsberg Architects, LLP, New York, NY

2. What We Know Now: Changes to the 1% Flood Map for the NYC Region

Lesley Patrick, Institute for Sustainable Cities Hunter College, City University of New York, New York, NY

3. Lessons Learned from Recovery from Tropical Storms

George Dubose, Member, Liberty Building Forensics Group, Zellwood, FL

4. Lessons Learned from International Storm Recovery

Norman Nelson, P.E., Member, CH2M Hill, Portland, OR

11:00 AM-12:30 PM

SEMINAR 58 (INTERMEDIATE)

Using System EER/COP to Reasonably Model GSHP System Performance

Track: *Systems and Equipment*

Room: *Trianon*

Sponsor: *06.08 Geothermal Heat Pumps and Energy Recovery Applications*

Chair: *Cary Smith, Member, Sound Geothermal Corp., Sandy, UT*



Design of renewable and net-zero building systems depends on accurately predicting system performance. Cost effective system options are sometimes tabled because available tools and rules of thumb don't accurately account for the system performance, especially for innovative hybrid, multi-stage, or

VFD-driven heat pump systems; GSHP systems are a prime example. Heat pumps and chillers unit ratings often fall short of predicting overall performance. This is especially true for government and utility programs for predictions used in paying rebates and incentives. This seminar explores the use of a more holistic System EER or COP to provide a more accurate "reality check" and performance model. Methods, metrics, and cases studies are presented.

1. Converting Imaginary (a.k.a. Rated) Efficiency to Real Efficiency

Steve Kavanaugh, Ph.D., Fellow ASHRAE, University of Alabama, Tuscaloosa, AL

2. GSHP System Cop: Design Choices Beyond the Borefield

Scott P. Hackel, P.E., Associate Member, Energy Center of Wisconsin, Madison, WI

3. Utility Management of Summer Peak Demand: Geothermal Heat Pump Advantages

Keith Swilley, Member, Gulf Power Company, Pensacola, FL

11:00 AM-12:30 PM

SEMINAR 59 (INTERMEDIATE)

Project Delivery from Design to Operation: The Good, the Bad, and the Ugly

Track: *Commissioning, Operation and Maintenance*

Room: *Rendezvous Trianon*

Sponsor: *07.03 Operation and Maintenance Management, 07.08 Owning and Operating Costs*

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



Turnover to maintenance may mean different things depending on which hat you are wearing—owner, design engineer, or contractor. How do differing perspectives on this concept impact the facility team tasked with maintaining a building? What role does project delivery methodology play in the turnover process? In this seminar, we will probe these questions in an effort to characterize ideal turnover. We will discuss the concept of design for maintenance and the influences that both project delivery method and turnover have on future maintenance efforts. The session will conclude with best practices for maximizing building life cycle performance.

1. Designing For Maintenance: The Owner's Perspective

Steven Pataki, Member, Toronto Cricket Skating and Curling Club, Toronto, ON, Canada

2. The Ideal Project Turnover Process: Striving for Successful Operation

Gary Bloom, Oak Ridge National Laboratory, Oak Ridge, TN

3. How Project Delivery Method Impacts Project Turnover & Operations

Matthew Mullen, P.E., Member, EMCOR Services New England Mechanical, Coventry, CT

11:00 AM-12:30 PM

SEMINAR 60 (INTERMEDIATE)

What You Need to Know about the Energy Standard for Buildings: ASHRAE/IES Standard 90.1-2013

Track: *Fundamentals and Applications*

Room: *Mercury*

Sponsor: *SSPC90.1*

Chair: *Bing Liu, P.E., Member, Pacific Northwest National Laboratory, Richland, WA*



ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI Approved; IESNA Co-sponsored), has been a benchmark and national model code for commercial buildings for over 35 years and indispensable for engineers and other professionals involved in the design of buildings and building systems. Now, with well over 100 addenda incorporated since the 2010 edition, Standard 90.1-2013 will significantly change the way buildings are built as these new modifications find their way into the world's energy codes. This session highlights some of the major changes that you can expect to see in building envelope, mechanical system and lighting requirements. In addition, the results of those changes on building energy efficiency since 2004 will be shown. This session is for anyone who wants advanced insight into the new standard's expected impacts on the industry.

1. Envelope Improvements in 90.1-2013*Len Sciarra, Member, Gensler, Chicago, IL***2. Mechanical System Improvements in 90.1-2013***Richard Lord, Fellow ASHRAE, Carrier Corporation, Murfreesboro, TN***3. Lighting System Improvements in 90.1-2013***Eric Richman, Member, Pacific Northwest National Laboratory, Richland, WA***4. Energy Performance Path Improvements in 90.1-2013***Michael Tillou, P.E., Member, Atelier Ten, Buffalo, NY*

11:00 AM-12:30 PM

SEMINAR 61 (INTERMEDIATE)**Using Smart Meters to Charge Up Building Energy Efficiency***Track: Building Information Systems**Room: Sutton South**Sponsor: 07.05 Smart Building Systems,**07.06, 04.07 Energy Calculations**Chair: Ram Narayanamurthy, Member, Electric Power Research Institute, Palo Alto, CA*

Utility Smart Meters have brought in a new era to building energy management by providing continuous time series data on building energy use. This time series data can be disaggregated to understand how the various loads in a building operate, both residential and commercial. Using this data, one can ascertain whether the equipment in a building is operating efficiently and whether the operating schedule is set correctly. Knowing this data enables improving energy efficiency of the buildings, as well as providing utilities with a measure of the demand reduction capability.

1. Using Home Energy Reports to Reduce Residential Energy Use*Steve Blanc, P.E., Member, Pacific Gas and Electric, San Francisco, CA***2. Using Smart Meter Data to Verify Residential Participation in Demand Response***Chris Holmes, P.E., Electric Power Research Institute, Knoxville, TN***3. Using Utility Billing Data to Identify Energy Efficiency and Demand Response Opportunities in Commercial Buildings***Domenic Armano, Associate Member, First Fuel, Boston, MA*

11:00 AM-12:30 PM

SEMINAR 62 (INTERMEDIATE)**Working with R-22 Replacement High Glide Blends***Track: Refrigeration**Room: Regent**Sponsor: 03.01 Refrigerants and Secondary Coolants**Chair: Christopher Seeton, Ph.D., Member, Shrieve, The Woodlands, TX*

Recent regulations phasing out R-22 have changed the landscape of the HVAC&R field with respect to appropriate R-22 replacements refrigerants. Unfortunately, there is not a direct replacement for R-22 and the industry realizing that refrigerant blends must be utilized. These blends, when used as drop-in or near drop-in, exhibit a temperature glide that makes charging and servicing more challenging.

1. Fractionation and Temperature Glide: Why it Happens and How to Handle it*Robert W. Yost, Member, National Refrigerants, Rosenhayen, NJ***2. Technology Issues Regarding Refrigerant Blends***Gustavo Pottker, Member, Honeywell - Buffalo Research Laboratory, Buffalo, NY***3. Practical Differences in Working with Low and High Glide Blends and Implications for Retrofitting***Gus Rolotti, Member and Stephen Spletzer, Member, Arkema, King of Prussia, PA***4. Retrofit Experience with Alternative Refrigerant R-438A in R-22 Air-Conditioning and Refrigeration Systems***Stefanie Kopchick, Member and Curtis Lawson, Member, DuPont, Wilmington, DE*

SOCIETY COMMITTEE MEETINGS

(Subcommittees are indented)

All Society Standing Committee Meetings will be held in the New York Hilton. The letter and numbers in parenthesis confirm the hotel and the floor location. (HC) is Hilton Concourse Level (H2) Hilton, 2nd floor.

ALPHABETICAL LISTING

Advocacy

Sun, 1/19, 6:30 am–8:30 am, Concourse G (HC)

AEDG Steering Committee

Mon, 1/20, 2:15 am–5:00 pm, Concourse E (HC)

ASHRAE Foundation

Mon, 1/20, 8:00 am–10:00 am, Concourse D (HC)

ASHRAE Foundation Executive Subcommittee

Sat, 1/18, 1:30 pm–3:00 pm, Conrad Hilton Suite (H4)

Associate Society Alliance

Sun, 1/19, 1:30 pm–4:30 pm, Gramercy West (H2)

Mon, 1/20, 4:15 pm–6:00 pm, Murray Hill (H2)

Board of Directors

Sun, 1/19, 1:30 pm–5:30 pm, Grand Ballroom West (H3)

Wed, 1/22, 2:00 pm–6:00 pm, Grand Ballroom West (H3)

Building Energy Quotient Committee

Sun, 1/19, 8:30 am–11:30 am, Madison (H2)

Building Performance Alliance Ad Hoc

Sat, 1/18, 2:00 pm–3:00 pm, Concourse F (HC)

Certification

Sat, 1/18, 8:00 am–12:00 pm, Midtown (H4)

Chapter Technology Transfer

Fri, 1/17, 8:00 am–12:00 pm, Gramercy West (H2)

Sat, 1/18, 8:00 am–12:00 pm, Madison (H2)

Chapter Technology Transfer Member Services

Fri, 1/17, 1:30 pm–5:00 pm, Gramercy West (H2)

Chapter Technology Transfer Operations

Fri, 1/17, 1:30 pm–5:00 pm, Clinton (H2)

Chapter Technology Transfer Executive

Fri, 1/17, 5:00 pm–6:00 pm, Gramercy West (H2)

CIBSE/ASHRAE Liaison

Wed, 1/22, 9:30 am–12:00 pm, Clinton (H2)

CLIMA

Sat, 1/18, 12:30 pm–1:30 pm, Harlem (H4)

College of Fellows

Sun, 1/19, 10:00 am–12:00 pm, Lincoln (H4)

College of Fellows Board/Advisory

Sun, 1/19, 8:00 am–10:00 am, Lincoln (H4)

Conferences and Expositions Annual and Winter Meetings

Fri, 1/17, 3:00 pm–6:00 pm, New York (H4)

Conferences and Expositions Committee

Sat, 1/18, 8:00 am–12:00 pm, Bryant (H2)

Conferences and Expositions Executive

Fri, 1/17, 1:00 pm–3:00 pm, New York (H4)

Developing Economies Ad Hoc

Mon, 1/20, 8:00 am–11:00 am, Hudson (H4)

Electronic Communications

Sat, 1/18, 11:00 am–3:00 pm, Concourse D (HC)

Environmental Health

Mon, 1/20, 2:15 pm–6:15 pm, Gibson (H2)

Environmental Health Executive

Mon, 1/20, 7:00 am–8:00 am, Gibson (H2)

Environmental Health Handbook/Research

Mon, 1/20, 8:00 am–10:00 am, Gibson (H2)

Environmental Health PMS 1491

Mon, 1/20, 6:30 pm–8:30 pm, Gibson (H2)

Environmental Health Policy/Program

Mon, 1/20, 10:00 am–12:00 pm, Gibson (H2)

Executive Committee

Sat, 1/18, 8:30 am–1:00 pm, Lincoln (H4)

Wed, 1/22, 7:30 am–9:00 am, Morgan (H2)

Thu, 1/23, 7:30 am–11:00 am, Hilton Boardroom (H4)

Finance Committee

Fri, 1/17, 8:00 am–1:00 pm, Bryant (H2)

Finance Investment Subcommittee

Thu, 1/16, 5:00 pm–7:00 pm, Concourse F (HC)

Finance Planning Subcommittee

Thu, 1/16, 5:00 pm–7:00 pm, Concourse H (HC)

Grassroots Government Activities Committee

Fri, 1/17, 1:00 pm–5:00 pm, Concourse G (HC)

Sat, 1/18, 10:30 am–1:00 pm, Concourse E (HC)

Grassroots Government Activities Member Services

Sat, 1/18, 7:30 am–10:00 am, Concourse E (HC)

Grassroots Government Activities Operations

Sat, 1/18, 7:30 am–10:00 am, Concourse D (HC)

Handbook

Sun, 1/19, 10:30 am–1:00 pm, Concourse G (HC)

Handbook 2015 HVAC Applications TCs/Volume Subcommittee

Sun, 1/19, 9:00 am–10:00 am, Conrad Hilton Suite (H4)

Handbook 2016 HVAC Systems and Equipment/TCs/Volume Subcommittee

Sun, 1/19, 9:00 am–10:00 am, Holland (H4)

Handbook 2017 Fundamentals/TCs Volume Subcommittee

Sun, 1/19, 9:00 am–10:00 am, Midtown (H4)

Handbook Electronic Media

Sun, 1/19, 8:00 am–9:00 am, Conrad Hilton Suite (H4)

Handbook Functional

Sun, 1/19, 8:00 am–9:00 am, Midtown (H4)

Handbook Strategic Planning/Excom

Sat, 1/18, 12:00 pm–3:00 pm, Clinton (H2)

Handbook Training for TC Handbook Chairs

Sun, 1/19, 7:45 am–8:45 am, Murray Hill (H2)

Handbook Volume Subcommittees

Sun, 1/19, 10:00 am–10:30 am, Concourse G (HC)

Historical Committee

Sun, 1/19, 8:30 am–12:00 pm, Concourse C (HC)

Honors & Awards

Sun, 1/19, 1:00 pm–5:00 pm, Concourse H (HC)

Mon, 1/20, 2:15 pm–5:30 pm, Hudson (H4)

IEQ Summit

Tue, 1/21, 2:15 pm–5:00 pm, Hudson (H4)

Journal Advertising Sales Subcommittee

Sun, 1/19, 7:00 am–8:00 am, Hilton Boardroom (H4)

Life Members' Executive Board

Tue, 1/21, 9:00 am–11:00 am, Hilton Boardroom (H4)

Members Council

Tue, 1/21, 8:00 am–12:00 pm, Gramercy West (H2)

Members Council Regional Operations

Sat, 1/18, 8:00 am–12:00 pm, Holland (H4)

Membership Promotion

Sat, 1/18, 8:00 am–3:00 pm, Morgan (H2)

Membership Promotion

Fri, 1/17, 1:00 pm–6:00 pm, Morgan (H2)

New Member Welcome

Sun, 1/19, 2:30 pm–3:30 pm, Petit Trianon (H3)

Nominating

Sun, 1/19, 7:30 am–12:00 pm, Gramercy West (H2)

PEA C

Tue, 1/21, 12:00 pm–2:00 pm, Hudson (H4)

Planning

Fri, 1/17, 1:00 pm–6:00 pm, Madison (H2)

Professional Development

Mon, 1/20, 8:00 am–12:00 pm, Harlem (H4)

Publications Committee

Sun, 1/19, 8:00 am–12:00 pm, Harlem (H4)

Publications Planning Subcommittee

Sat, 1/18, 10:00 am–12:00 pm, Clinton (H2)

Publishing and Education Council

Tue, 1/21, 8:00 am–12:00 pm, Morgan (H2)

Publishing and Education Council E-Learning

Sat, 1/18, 1:30 pm–3:00 pm, Harlem (H4)

Publishing and Education Council Fiscal

Mon, 1/20, 2:00 pm–3:30 pm, Midtown (H4)

Publishing and Education Council Functional

Mon, 1/20, 3:30 pm–5:00 pm, Midtown (H4)

Publishing and Education Council HVAC&R Research Subcommittee

Mon, 1/20, 11:00 am–12:00 pm, Hudson (H4)

Refrigeration Committee

Sun, 1/19, 8:00 am–12:00 pm, Concourse B (HC)

Refrigeration Excom

Sun, 1/19, 7:00 am–8:00 am, Concourse B (HC)

Refrigeration RP 1634 PMS

Sun, 1/19, 5:00 pm–7:00 pm, Harlem (H4)

Region-at-Large Planning

Mon, 1/20, 2:15 pm–4:15 pm, Murray Hill (H2)

Research Administration

Fri, 1/17, 2:00 pm–6:00 pm, Murray Hill West (H2)

Sat, 1/18, 8:00 am–3:00 pm, Gramercy West (H2)

Wed, 1/22, 7:00 am–11:00 am, Murray Hill West (H2)

Research Administration Executive

Fri, 1/17, 1:00 pm–2:00 pm, Murray Hill West (H2)

Research Subcommittee Chairs

Mon, 1/20, 6:30 am–9:00 am, Grand Ballroom (H3)

Research Promotion

Sat, 1/18, 7:30 am–1:00 pm, Concourse C (HC)

Research Promotion Executive

Fri, 1/17, 2:00 pm–6:00 pm, Midtown (H4)

Residential Market Ad Hoc

Sun, 1/19, 8:00 am–11:00 am, Concourse E (HC)

Scholarship Trustees

Tue, 1/21, 8:00 am–12:00 pm, East (H4)

Society Rules

Tue, 1/21, 2:00 pm–5:00 pm, Hilton Boardroom (H4)

Standards

Sat, 1/18, 8:00 am–1:00 pm, Petit Trianon (H3)

Wed, 1/22, 7:30 am–9:30 am, Grand Ballroom West (H3)

Standards Code Interaction

Sun, 1/19, 7:00 pm–10:00 pm, Madison (H2)

Standards Executive

Fri, 1/17, 8:00 am–12:00 pm, Hudson (H4)

Standards ILS/ISAS

Fri, 1/17, 1:00 pm–4:00 pm, Holland (H4)

Standards PC Chair Breakfast

Sun, 1/19, 7:00 am–9:00 am, Petit Trianon (H3)

Standards PPIS

Fri, 1/17, 2:00 pm–5:00 pm, Hudson (H4)

Tue, 1/21, 11:00 am–2:00 pm, Midtown (H4)

Standards SPLS

Tue, 1/21, 2:00 pm–4:00 pm, Midtown (H4)

Fri, 1/17, 2:00 pm–6:00 pm, Bryant (H2)

Standards SRS

Tue, 1/21, 5:00 pm–6:00 pm, Midtown (H4)

Student Activities

Sat, 1/18, 8:00 am–3:00 pm, Gibson (H2)

Student Activities Design Competition

Fri, 1/17, 4:00 pm–6:00 pm, Hilton Boardroom (H4)

Student Activities Executive

Fri, 1/17, 9:30 am–12:00 pm, Hilton Boardroom (H4)

Student Activities Grants

Fri, 1/17, 4:00 pm–6:00 pm, Lincoln (H4)

Student Activities K-12/STEM

Fri, 1/17, 12:00 pm–2:00 pm, Hilton Boardroom (H4)

Student Activities Post High/ABET

Fri, 1/17, 2:00 pm–4:00 pm, Hilton Boardroom (H4)

Student Congress

Mon, 1/20, 10:00 am–12:00 pm, Clinton (H2)

Student Program

Sun, 1/19, 9:00 am–2:00 pm, Grand Ballroom East (H3)

Student Welcome and Orientation

Sat, 1/18, 2:00 pm–3:00 pm, Beekman

Student/YEA Mixer

Sat, 1/18, 5:00 pm–6:30 pm, Concourse A (HC)

TAC/CEC Executive

Sat, 1/18, 7:00 am–8:00 am, Gramercy East (H2)

TC/CEC Training

Tue, 1/21, 11:00 am–12:00 pm, Harlem (H4)

Technical Activities

Sat, 1/18, 8:00 am–3:00 pm, Gramercy East (H2)

Wed, 1/22, 7:00 am–10:00 am, Bryant (H2)

Technology Council

Wed, 1/22, 8:00 am–11:00 am, Gramercy East (H2)

Technology Council Air Filtration and Cleaning Position Document Committee

Tue, 1/21, 11:00 am–1:00 pm, Hilton Boardroom (H4)

Technology Council Document Review Subcommittee

Tue, 1/21, 11:00 am–12:00 pm, Madison (H2)

Technology Council Operation/Planning

Tue, 1/21, 7:30 am–9:30 am, Madison (H2)

Technology Council Special Projects

Tue, 1/21, 9:30 am–11:00 am, Madison (H2)

YEA Hospitality

Sun, 1/19, 4:00 pm–7:00 pm, Petit Trianon (H3)

Young Engineers in ASHRAE Committee

Sun, 1/19, 7:00 am–12:00 pm, Concourse D (HC)

CHRONOLOGICAL

Thursday, January 16

Finance Investment Subcommittee

Thu, 5:00 pm–7:00 pm, Concourse F (HC)

Finance Planning Subcommittee

Thu, 5:00 pm–7:00 pm, Concourse H (HC)

Friday, January 17

Chapter Technology Transfer

Fri, 8:00 am–12:00 pm, Gramercy West (H2)

Standards Executive

Fri, 8:00 am–12:00 pm, Hudson (H4)

Finance Committee

Fri, 8:00 am–1:00 pm, Bryant (H2)

Student Activities Executive

Fri, 9:30 am–12:00 pm, Hilton Boardroom (H4)

Student Activities K-12/STEM

Fri, 12:00 pm–2:00 pm, Hilton Boardroom (H4)

Research Administration Executive

Fri, 1:00 pm–2:00 pm, Murray Hill West (H2)

Conferences and Expositions Executive

Fri, 1:00 pm–3:00 pm, New York (H4)

Standards ILS/ISAS

Fri, 1:00 pm–4:00 pm, Holland (H4)

Grassroots Government Activities Committee

Fri, 1:00 pm–5:00 pm, Concourse G (HC)

Membership Promotion

Fri, 1:00 pm–6:00 pm, Morgan (H2)

Planning

Fri, 1:00 pm–6:00 pm, Madison (H2)

Chapter Technology Transfer Member Services

Fri, 1:30 pm–5:00 pm, Gramercy West (H2)

Chapter Technology Transfer Operations

Fri, 1:30 pm–5:00 pm, Clinton (H2)

Student Activities Post High/ABET

Fri, 2:00 pm–4:00 pm, Hilton Boardroom (H4)

Standards PPIS

Fri, 2:00 pm–5:00 pm, Hudson (H4)

Research Administration

Fri, 2:00 pm–6:00 pm, Murray Hill West (H2)

Research Promotion Executive

Fri, 2:00 pm–6:00 pm, Midtown (H4)

Standards SPLS

Fri, 2:00 pm–6:00 pm, Bryant (H2)

Conferences and Expositions Annual and Winter Meetings

Fri, 3:00 pm–6:00 pm, New York (H4)

Student Activities Design Competition

Fri, 4:00 pm–6:00 pm, Hilton Boardroom (H4)

Student Activities Grants

Fri, 4:00 pm–6:00 pm, Lincoln (H4)

Chapter Technology Transfer Executive

Fri, 5:00 pm–6:00 pm, Gramercy West (H2)

Saturday, January 18

TAC/CEC Executive

Sat, 7:00 am–8:00 am, Gramercy East (H2)

Grassroots Government Activities Member Services

Sat, 7:30 am–10:00 am, Concourse E (HC)

Grassroots Government Activities Operations

Sat, 7:30 am–10:00 am, Concourse D (HC)

Research Promotion

Sat, 7:30 am–1:00 pm, Concourse C (HC)

Members Council Regional Operations

Sat, 8:00 am–12:00 pm, Holland (H4)

Conferences and Expositions Committee

Sat, 8:00 am–12:00 pm, Bryant (H2)

Certification

Sat, 8:00 am–12:00 pm, Midtown (H4)

Chapter Technology Transfer

Sat, 8:00 am–12:00 pm, Madison (H2)

Standards

Sat, 8:00 am–1:00 pm, Petit Trianon (H3)

Technical Activities

Sat, 8:00 am–3:00 pm, Gramercy East (H2)

Membership Promotion

Sat, 8:00 am–3:00 pm, Morgan (H2)

Student Activities

Sat, 8:00 am–3:00 pm, Gibson (H2)

Research Administration

Sat, 8:00 am–3:00 pm, Gramercy West (H2)

Executive Committee

Sat, 8:30 am–1:00 pm, Lincoln (H4)

Publications Planning Subcommittee

Sat, 10:00 am–12:00 pm, Clinton (H2)

Grassroots Government Activities Committee

Sat, 10:30 am–1:00 pm, Concourse E (HC)

Electronic Communications

Sat, 11:00 am–3:00 pm, Concourse D (HC)

Handbook Strategic Planning/Excom

Sat, 12:00 pm–3:00 pm, Clinton (H2)

CLIMA

Sat, 12:30 pm–1:30 pm, Harlem (H4)

Building Performance Alliance Ad Hoc

Sat, 2:00 pm–3:00 pm, Concourse F (HC)

ASHRAE Foundation Executive Subcommittee

Sat, 1:30 pm–3:00 pm, Conrad Hilton Suite (H4)

Publishing and Education Council E-Learning

Sat, 1:30 pm–3:00 pm, Harlem (H4)

Student Welcome and Orientation

Sat, 2:00 pm–3:00 pm, Beekman

Student/YEA Mixer

Sat, 5:00 pm–6:30 pm, Concourse A (HC)

Sunday, January 19**Advocacy**

Sun, 6:30 am–8:30 am, Concourse G (HC)

Refrigeration Excom

Sun, 7:00 am–8:00 am, Concourse B (HC)

Standards PC Chair Breakfast

Sun, 7:00 am–9:00 am, Petit Trianon (H3)

Journal Advertising Sales Subcommittee

Sun, 7:00 am–8:00 am, Hilton Boardroom (H4)

Young Engineers in ASHRAE Committee

Sun, 7:00 am–12:00 pm, Concourse D (HC)

Nominating

Sun, 7:30 am–12:00 pm, Gramercy West (H2)

Handbook Training for TC Handbook Chairs

Sun, 7:45 am–8:45 am, Murray Hill (H2)

Handbook Electronic Media

Sun, 8:00 am–9:00 am, Conrad Hilton Suite (H4)

Handbook Functional

Sun, 8:00 am–9:00 am, Midtown (H4)

College of Fellows Board/Advisory

Sun, 8:00 am–10:00 am, Lincoln (H4)

Residential Market Ad Hoc

Sun, 8:00 am–11:00 am, Concourse E (HC)

Refrigeration Committee

Sun, 8:00 am–12:00 pm, Concourse B (HC)

Publications Committee

Sun, 8:00 am–12:00 pm, Harlem (H4)

Building Energy Quotient Committee

Sun, 8:30 am–11:30 am, Madison (H2)

Historical Committee

Sun, 8:30 am–12:00 pm, Concourse C (HC)

Handbook 2017 Fundamentals/TCs Volume Subcommittee

Sun, 9:00 am–10:00 am, Midtown (H4)

Handbook 2015 HVAC Applications TCs/Volume

Subcommittee

Sun, 9:00 am–10:00 am, Conrad Hilton Suite (H4)

Handbook 2016 HVAC Systems and Equipment/TCs/Volume

Subcommittee

Sun, 9:00 am–10:00 am, Holland (H4)

Student Program

Sun, 9:00 am–2:00 pm, Grand Ballroom East (H3)

Handbook Volume Subcommittees

Sun, 10:00 am–10:30 am, Concourse G (HC)

College of Fellows

Sun, 10:00 am–12:00 pm, Lincoln (H4)

Handbook

Sun, 10:30 am–1:00 pm, Concourse G (HC)

Honors & Awards

Sun, 1:00 pm–5:00 pm, Concourse H (HC)

Associate Society Alliance

Sun, 1:30 pm–4:30 pm, Gramercy West (H2)

Board of Directors

Sun, 1:30 pm–5:30 pm, Grand Ballroom West (H3)

New Member Welcome

Sun, 2:30 pm–3:30 pm, Petit Trianon (H3)

YEA Hospitality

Sun, 4:00 pm–7:00 pm, Petit Trianon (H3)

Refrigeration RP 1634 PMS

Sun, 5:00 pm–7:00 pm, Harlem (H4)

Standards Code Interaction

Sun, 7:00 pm–10:00 pm, Madison (H2)

Monday, January 20

Research Subcommittee Chairs

Mon, 6:30 am–9:00 am, Grand Ballroom (H3)

Environmental Health Executive

Mon, 7:00 am–8:00 am, Gibson (H2)

Developing Economies Ad Hoc

Mon, 8:00 am–11:00 am, Hudson (H4)

ASHRAE Foundation

Mon, 8:00 am–10:00 am, Concourse D (HC)

Environmental Health Handbook/Research

Mon, 8:00 am–10:00 am, Gibson (H2)

Professional Development

Mon, 8:00 am–12:00 pm, Harlem (H4)

Student Congress

Mon, 10:00 am–12:00 pm, Clinton (H2)

Environmental Health Policy/Program

Mon, 10:00 am–12:00 pm, Gibson (H2)

Publishing and Education Council HVAC&R Research Subcommittee

Mon, 11:00 am–12:00 pm, Hudson (H4)

Publishing and Education Council Fiscal

Mon, 2:00 pm–3:30 pm, Midtown (H4)

AEDG Steering Committee

Mon, 2:15 am–5:00 pm, Concourse E (HC)

Region-at-Large Planning

Mon, 2:15 pm–4:15 pm, Murray Hill (H2)

Honors & Awards

Mon, 2:15 pm–5:30 pm, Hudson (H4)

Environmental Health

Mon, 2:15 pm–6:15 pm, Gibson (H2)

Publishing and Education Council Functional

Mon, 3:30 pm–5:00 pm, Midtown (H4)

Associate Society Alliance

Mon, 4:15 pm–6:00 pm, Murray Hill (H2)

Environmental Health PMS 1491

Mon, 6:30 pm–8:30 pm, Gibson (H2)

Tuesday, January 21

Technology Council Operation/Planning

Tue, 7:30 am–9:30 am, Madison (H2)

Members Council

Tue, 8:00 am–12:00 pm, Gramercy West (H2)

Scholarship Trustees

Tue, 8:00 am–12:00 pm, East (H4)

Publishing and Education Council

Tue, 8:00 am–12:00 pm, Morgan (H2)

Life Members' Executive Board

Tue, 9:00 am–11:00 am, Hilton Boardroom (H4)

Technology Council Special Projects

Tue, 9:30 am–11:00 am, Madison (H2)

TC/CEC Training

Tue, 11:00 am–12:00 pm, Harlem (H4)

Technology Council Document Review Subcommittee

Tue, 11:00 am–12:00 pm, Madison (H2)

Technology Council Air Filtration and Cleaning Position

Document Committee

Tue, 11:00 am–1:00 pm, Hilton Boardroom (H4)

Standards PPIS

Tue, 11:00 am–2:00 pm, Midtown (H4)

PEAC

Tue, 12:00 pm–2:00 pm, Hudson (H4)

Standards SPLS

Tue, 2:00 pm–4:00 pm, Midtown (H4)

Society Rules

Tue, 2:00 pm–5:00 pm, Hilton Boardroom (H4)

IEQ Summit

Tue, 2:15 pm–5:00 pm, Hudson (H4)

Standards SRS

Tue, 5:00 pm–6:00 pm, Midtown (H4)

Wednesday, January 22

Technical Activities

Wed, 7:00 am–10:00 am, Bryant (H2)

Research Administration

Wed, 7:00 am–11:00 am, Murray Hill West (H2)

Executive Committee

Wed, 7:30 am–9:00 am, Morgan (H2)

Standards

Wed, 7:30 am–9:30 am, Grand Ballroom West (H3)

Technology Council

Wed, 8:00 am–11:00 am, Gramercy East (H2)

CIBSE/ASHRAE Liaison

Wed, 9:30 am–12:00 pm, Clinton (H2)

Board of Directors

Wed, 2:00 pm–6:00 pm, Grand Ballroom West (H3)

Thursday, January 23

Executive Committee

Thu, 7:30 am–11:00 am, Hilton Boardroom (H4)

notes

TC/TG/MTG/TRG/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.

Finding your meeting location:

There are TC/SPC committees scheduled at both the New York Hilton and the Sheraton. To get to the Sheraton, please exit the Hilton from the Lobby Level exit located near the front desk or through the exit to the parking garage to 53rd Street. The Sheraton's address is 711 7th Avenue on 53rd Street. The Sheraton is across the street from the Hilton on 53rd. Please note that there are some room names that are the same or similar to rooms in the Hilton. One example is Madison. If it is the Madison in the Hilton there will be no number associated with it and there will be an (H) for Hilton next to the room name. If it is Madison 1 to 6 it is the Sheraton with an (S). All of the meeting rooms except Madison and Park are in the conference center of the hotel and accessible via elevator. Madison and Park are accessible via the elevator in the main lobby of the hotel on the 5th floor.

Codes:

(H2) is Hilton, 2nd Floor **(HC)** Hilton Concourse Level,
(SL) Sheraton, Lower Level, **(S5)** Sheraton, 5th Floor

The meetings in color have been confirmed. The meetings with no color have not been confirmed so they may or may not be meeting.

TC/TG Chair's Breakfast

Sun, 6:30 am–8:00 am,
Section 1 Madison (H2)
Section 2 Concourse H (HC)
Section 3 Concourse F (HC)
Section 4 Holland (H4)
Section 5 Morgan (H2)
Section 6 Gramercy East (H2)
Section 7 Clinton (H2)
Section 8 Bryant (H2)
Section 9 East (H4)
Section 10 Concourse C (HC)

TC/TG Chair's Training Workshop

Sun, 9:45 am–10:45 am, Sutton Center (H2)

Research Subcommittee Breakfast

Mon, 6:30 am–8:00 am, Grand Ballroom (H3)

TC Program Subcommittee Training

Tue, 11:15 am–12:00 pm, Harlem (H4)

TC 1.1 Thermodynamics & Psychrometrics (10/15)

Mon, 2:15 pm–4:15 pm, Madison 1 (S5)

TC 1.2 Instruments & Measurements (15/)

Tue, 1:00 pm–3:30 pm, Madison 5 (S5)

TC 1.2 Standards/Handbook (5/2)

Mon, 4:15 pm–6:30 pm, Park 4 (S5)

TC 1.3 Heat Transfer & Fluid Flow (25/25)

Tue, 1:00 pm–3:30 pm, Morgan (H2)

TC 1.3 Handbook

Sun, 1:00 pm–3:00 pm, Madison 2 (S5)

TC 1.3/8.5 Research (15/20)

Sun, 3:00 pm–7:00 pm, Rendezvous Trianon (H3)

TC 1.4 Control Theory & Application (20/20) Screen/E

Sponsoring: Seminar 54: HVAC&R Paper Seminar: RP-1353 Stability and Accuracy of VAV Box Control at Low Flows and Seminar 1: Integration for Successful Operations: Avoid a Recipe for Disaster—Get the Right Cooks in the Kitchen!

Tue, 1:00 pm–3:30 pm, East (H4)

TC 1.4 RP 1597 (6/2) Screen/E

Sun, 10:00 am–11:00 am, Hudson (H4)

TC 1.4 Control Components and Applications (20/5)

Sun, 3:00 pm–4:30 pm, Madison 4 (S5)

TC 1.4 Program (20/5)

Sun, 4:30 pm–5:30 pm, Madison 4 (S5)

TC 1.4 Education (20/5)

Sun, 5:30 pm–6:30 pm, Madison 4 (S5)

TC 1.4 RP 1455 PMS (8/0) Screen/E

Mon, 9:00 am–10:00 am, Conrad Hilton Suite (H4)

TC 1.4 Research (20/5) Screen/E

Mon, 2:15 pm–4:15 pm, Concourse D (HC)

TC 1.4 Handbook (10/5) Screen/E

Mon, 4:15 pm–6:30 pm, Concourse D (HC)

TC 1.4 Executive (8/0)

Tue, 7:00 am–8:00 am, Conrad Hilton Suite (H4)

TC 1.4 RP 1633 PMS (8/) Screen/E

Tue, 9:00 am–10:00 am, Conrad Hilton Suite (H4)

TC 1.5 Computer Applications (20/5)

Sponsoring: Seminar 48: App, App and Away: Enabling Meaningful Work for the Building Professional with the Development of Quality Apps for Smartphones and Tablet Computers and Seminar 9: Emerging Technologies in the Built Environment: Geographic Information Science (GIS), 3D Printing, and Additive Manufacturing

Mon, 6:30 pm–9:00 pm, Bryant (H2)

TC 1.5 Emerging Applications (6/10)

Sun, 5:00 pm–6:00 pm, Lincoln (H4)

TC 1.5 Research (6/10)

Sun, 6:00 pm–7:00 pm, Lincoln (H4)

TC 1.5 Program

Sun, 7:00 pm–8:00 pm, Lincoln (H4)

TC 1.5 Handbook (6/10)

Mon, 6:00 pm–6:30 pm, Lincoln (H4)

TC 1.6 Terminology (10/8)

Mon, 4:15 pm–6:30 pm, Sutton Center

TC 1.7 Business, Management & General Legal Education (20/5)

Sponsoring: Workshop 2: Engineering Ethics: A Case Study Analysis

Mon, 10:15 am–12:00 pm, Midtown (H4)

TC 1.8 Mechanical Systems Insulation (6/6)

Mon, 4:15 pm–6:30 pm, Harlem (H4)

TC 1.8 Research (6/6)

Sun, 8:00 am–9:00 am, Madison 2 (S5)

TC 1.8 Handbook

Sun, 9:00 am–10:00 am, Madison 2 (S5)

TC 1.8 Program

Sun, 10:00 am–10:30 am, Madison 2 (S5)

TC 1.9 Electrical Systems (8/4)

Tue, 3:30 pm–6:00 pm, Holland (H4)

TC 1.10 (20/10)

Sponsoring: Seminar 16: Efficient Technologies That Are Also Economically Sustainable, Part 2 of 3: Combined Heat & Power (CHP) and Complementary Options

Tue, 3:30 pm–5:00 pm, Conference Room K (SL)

TC 1.10 Program/Handbook/Research

Tue, 1:00 pm–3:00 pm, Conference Room C (SL)

TC 1.11 Electric Motors and Motor Control (13/7)

Tue, 1:00 pm–3:30 pm, Holland (H4)

TC 1.12 Moisture Management in Buildings (15/25)

Sponsoring: Seminar 57: Lessons Learned from Storm Recovery

Sat, 1:00 pm–3:00 pm, Conference Room K (SL)

TC 1.12 Program/Research/Handbook

Sat, 8:00 am–12:00 pm, Conference Room K (SL)

TC 2.1 Physiology & Human Environment (12/18)

Tue, 1:00 pm–4:00 pm, Beekman (H2)

Sponsoring: Seminar: Performance of Non-Western Clothing: Expanding ASHRAE's Database

TC 2.1 Research (13/7)

Sun, 1:00 pm–3:00 pm, Executive Boardroom (SL)

TC 2.1 Programs

Sun, 3:00 pm–4:00 pm, Executive Boardroom (SL)

TC 2.1 Handbook

Sun, 4:00 pm–5:00 pm, Executive Boardroom (SL)

TC 2.2 Plant and Animal Environment (10/5)

Sponsoring: Technical Paper Session 9: Advances in Measurement and Modeling of Indoor Environmental Quality of Animal Buildings

Mon, 4:15 pm–6:30 pm, Hilton Boardroom (H4)

TC 2.3 Gaseous Air Contaminants /Removal Equip. (18/20) Screen

Sponsoring: Conference Paper Session 2: Filter Media Performance

Tue, 1:00 pm–3:30 pm, Concourse B (HC)

TC 2.3 Research (20/5)

Sun, 5:00 pm–7:00 pm, Riverside Suite (S3)

TC 2.3 Handbook (5/5)

Mon, 4:15 pm–6:00 pm, Conference Room L (SL)

TC 2.3 Standards (20/5)

Mon, 6:00 pm–8:00 pm, Concourse B (HC)

TC 2.3 Planning (15/5)

Tue, 6:30 am–8:00 am, Hilton Boardroom (H4)

TC 2.3 Program (20/5)

Tue, 12:00 pm–12:45 pm, Concourse B (HC)

TC 2.4 Particulate Air Contaminants /Removal Equip. (18/30)

Sponsoring: Seminar 37: Real Cost of Filtration and Seminar 28: A Comprehensive Look at Infectious Disease and Air Filtration in Healthcare Facilities: Energy Saving, IAQ Performance, and What Makes You Sick

Tue, 3:30 pm–6:00 pm, Concourse B (HC)

TC 2.4 Handbook (10/10)

Sat, 1:00 pm–2:30 pm, Madison 2 (S5)

TC 2.4 Research (20/20)

Sun, 3:00 pm–5:00 pm, Riverside Suite (S3)

TC 2.4 Planning (20/10)

Mon, 8:00 am–10:00 am, Concourse B (HC)

TC 2.4 Program (20/10)

Mon, 10:00 am–11:00 am, Concourse B (HC)

TC 2.4 Standards (20/20)

Mon, 4:15 pm–6:00 pm, Concourse B (HC)

TC 2.5 Global Climate Change (20/10)

Tue, 1:30 pm–3:30 pm, Conference Room L (SL)

TC 2.6 Sound & Vibration Control (20/40) Screen/E

Sponsoring: Seminar 12: Hydronic System Acoustics

Mon, 2:15 pm–4:15 pm, New York (H4)

TC 2.6 RP 1408 PMS (20/25)Screen/E

Sun, 9:00 am–10:00 am, East (H4)

TC 2.6 PES RP 1529

Sun, 10:00 am–11:00 am, East (H4)

TC 2.6 Hot Topic 1

Sun, 11:00 am–12:00 pm, East (H4)

TC 2.6 Hot Topic 2

Sun, 1:00 pm–1:30 pm, East (H4)

TC 2.6 Research

Sun, 3:00 pm–4:00 pm, East (H4)

TC 2.6 Criteria

Sun, 4:00 pm–5:00 pm, East (H4)

TC 2.6 Excom

Sun, 5:00 pm–6:00 pm, East (H4)

TC 2.6 Vibration Isolation Screen

Mon, 9:00 am–10:00 am, New York (H4)

TC 2.6 Publications

Mon, 10:00 am–11:00 am, New York (H4)

TC 2.6 Programs

Mon, 11:00 am–12:00 pm, New York (H4)

TC 2.7 Seismic and Wind Restraint Design (16/20) Screen/E

Tue, 3:30 pm–6:00 pm, Harlem (H4)

TC 2.7 Research & Programs (15/20)

Tue, 1:00 pm–2:30 pm, Harlem (H4)

TC 2.7 Publications & Handbook

Tue, 2:30 pm–3:30 pm, Harlem (H4)

TC 2.8 Building Environmental Impacts and Sustainability (20/50)

Sponsoring: Seminar 49: Are Renewable Resources Renewable Energy? A Life Cycle Assessment Perspective, Seminar 35: Sustainable Development in Africa, Seminar 7: The Façade Odyssey: Solutions for Design of High Performance Buildings, Seminar 41: Blue is the New Green: The Emerging Focus on Building Water Use Reduction, and ultraSeminar 29: Advanced RTU Campaign: Accelerating Efficiency

Sun, 5:00 pm–7:00 pm, Gramercy East (H2)

TC 2.8 International (8/4)

Sun, 12:30 pm–1:15 pm, Concourse E (HC)

TC 2.8 Green Guide (12/8)

Sun, 1:15 pm–1:45 pm, Concourse E (HC)

TC 2.8 Research (10/4)

Sun, 1:45 pm–2:30 pm, Concourse E (HC)

TC 2.8 Handbook (8/6)

Sun, 2:30 pm–3:15 pm, Concourse E (HC)

TC 2.8 Program (12/8)

Sun, 3:15 pm–4:00 pm, Concourse E (HC)

TC 2.8 Existing Buildings (8/8)

Sun, 4:00 pm–4:30 pm, Concourse E (HC)

TC 2.9 Ultraviolet Air and Surface Treatment (20/10)

Sponsoring: Workshop: Ultraviolet Applications in a Healthcare Environment

Mon, 10:00 am–12:00 pm, Concourse G (HC)

TC 2.9 Program, Handbook, Standards (20/15)

Sun, 8:00 am–12:00 pm, Conference Room E (SL)

TC 2.9 Research

Mon, 8:00 am–10:00 am, Concourse G (HC)

TC 3.1 Refrigerants & Secondary Coolants (20/15) Screen/E

Sponsoring: Seminar 62: Working with R-22 Replacement High Glide Blends

Mon, 4:15 pm–6:30 pm, East (H4)

TC 3.1 Research (10/10) Screen/E

Mon, 11:00 am–12:00 pm, East (H4)

TC 3.1 Program and Handbook (10/10) Screen/E

Mon, 2:15 pm–4:15 pm, East (H4)

TC 3.2 Refrigerant System Chemistry (12/40)

Mon, 2:15 pm–4:15 pm, Regent (H2)

TC 3.2 Research (12/18)

Sun, 4:00 pm–5:00 pm, Hudson (H4)

TC 3.3 Refrigerant Contaminant Control (20/30) Screen

Tue, 3:30 pm–6:00 pm, Petit Trianon (H3)

TC 3.3 Research (12/18)

Sun, 5:00 pm–5:30 pm, Hudson (H4)

TC 3.4 Lubrication (20/40)

Sponsoring: Seminar: Lubricants Optimized for use with Low Global Warming Potential Refrigerants

Tue, 1:30 pm–3:30 pm, Petit Trianon (H3)

TC 3.4 Research (12/18)

Sun, 5:30 pm–6:00 pm, Hudson (H4)

TC 3.6 Water Treatment (18/10)

Sponsoring: Workshop 4: Increasing Role of Advanced Equipment of Control and Monitoring in the Water Treatment Industry

Tue, 1:00 pm–3:30 pm, Madison 2 (S5)

TC 3.6 Handbook/Program/Research (12/6)

Sun, 3:00 pm–5:00 pm, Concourse F (HC)

TC 3.8 Refrigerant Containment (9/5)

Mon, 4:15 pm–6:30 pm, Concourse H (HC)

TC 4.1 Load Calculation Data and Procedures (15/10)

Sponsoring: Seminar 8: The Latest Trends and Abilities of Mobile Applications for Load Calculations and Building Energy Evaluations and Seminar 42: Cooling Load Calculations for Radiant and Underfloor Air Distribution (UFAD) Systems: Are They the Same as Traditional Methods?

Mon, 2:15 pm–4:15 pm, Executive Boardroom (SL)

TC 4.1 Handbook

Sun, 3:00 pm–4:00 pm, Madison 2 (S5)

TC 4.1 Research

Sun, 4:00 pm–5:00 pm, Madison 2 (S5)

TC 4.1 Programs & Standards

Sun, 5:00 pm–7:00 pm, Madison 2 (S5)

TC 4.2 Climatic Information (20/10) Screen

Tue, 1:00 pm–3:30 pm, Conference Room D (SL)

TC 4.2 1561 PMS (10) Screen

Sun, 1:00 pm–2:30 pm, Bryant (H2)

TC 4.2 Program (20/0) Screen

Sun, 2:30 pm–3:30 pm, Bryant (H2)

TC 4.2 1699 RP PES (20/0) Screen

Sun, 3:30 pm–5:00 pm, Bryant (H2)

TC 4.2 Research (20/0)

Mon, 4:15 pm–6:00 pm, Madison 1 (S5)

TC 4.3 Ventilation Requirements & Infiltration (15/10) Screen

Sponsoring: Seminar 38: Advances in Ventilation

Mon, 4:15 pm–6:30 pm, Concourse C (HC)

TC 4.4 Bldg. Materials and Bldg. Envelope Performance (20/20)

Mon, 2:15 pm–4:15 pm, Concourse B (HC)

TC 4.4 Research (12/20) Screen

Sun, 1:00 pm–3:00 pm, Conference Room D (SL)

TC 4.4 Handbook (12/20) Screen

Sun, 3:00 pm–3:30 pm, Conference Room D (SL)

TC 4.4 Program (12/20) Screen

Sun, 3:30 pm–5:00 pm, Conference Room D (SL)

TC 4.4 Standards (12/20) Screen

Sun, 5:00 pm–5:30 pm, Conference Room D (SL)

TC 4.5 Fenestration (10/10)

Mon, 2:15 pm–4:15 pm, Beekman (H2)

TC 4.5 Computational Methods

Sun, 1:00 pm–3:00 pm, Holland (H4)

TC 4.5 Research & Long Range Planning

Sun, 3:00 pm–4:00 pm, Holland (H4)

TC 4.5 Program

Sun, 4:00 pm–5:00 pm, Holland (H4)

TC 4.5 Handbook

Sun, 5:00 pm–6:00 pm, Holland (H4)

TC 4.7 Energy Calculations (25/50)

Sponsoring: Seminar 52: How Much Energy Saving can we Expect from Natural Ventilation?

Tue, 6:00 pm–8:30 pm, Rendezvous Trianon (H3)

TC 4.7 Simulation and Component Models (20/20) Screen/E

Mon, 6:00 pm–7:30 pm, Concourse E (HC)

TC 4.7 Data-Driven Models

Mon, 7:30 pm–9:00 pm, Concourse E (HC)

TC 4.7 Applications (25/5) Screen/E

Tue, 3:30 pm–5:00 pm, Rendezvous Trianon (H3)

TC 4.7 Handbook

Tue, 5:00 pm–6:00 pm, Rendezvous Trianon (H3)

TC 4.10 Indoor Environmental Modeling (20/20)

Mon, 2:15 pm–4:15 pm, Madison (H2)

TC 4.10 RP 1512 PMS (15/0)

Sun, 2:30 pm–3:30 pm, Conference Room K (SL)

TC 4.10 Program

Sun, 3:30 pm–4:30 pm, Conference Room K (SL)

TC 4.10 Handbook

Sun, 4:30 pm–5:00 pm, Conference Room K (SL)

TC 4.10 Research

Sun, 5:00 pm–6:00 pm, Conference Room K (SL)

TC 5.1 Fans (20/5)

Mon, 4:15 pm–6:30 pm, Concourse F (HC)

TC 5.1 Handbook (5/15)

Sun, 3:30 pm–4:30 pm, Regent (H2)

TC 5.1 Research, Program Standards

Sun, 4:30 pm–6:00 pm, Regent (H2)

- TC 5.1 PMS for RP 1420**
Sun, 6:00 pm–7:00 pm, Regent (H2)
- TC 5.2 Duct Design (12/20) Screen**
Tue, 3:30 pm–6:00 pm, Clinton (H2)
- TC 5.2 Vision (20/5)**
Sun, 1:30 pm–2:00 pm, Lincoln (H4)
- TC 5.2 Standards/Handbook**
Sun, 2:00 pm–2:15 pm, Lincoln (H4)
- TC 5.2 Research**
Sun, 2:15 pm–2:45 pm, Lincoln (H4)
- TC 5.2 MTG**
Sun, 2:45 pm–3:15 pm, Lincoln (H4)
- TC 5.2 Membership**
Sun, 3:15 pm–3:45 pm, Lincoln (H4)
- TC 5.2 Publications**
Sun, 3:45 pm–4:00 pm, Lincoln (H4)
- TC 5.2 Duct Design Guide (20/10) Screen**
Mon, 8:00 am–9:30 am, Conference Room L (SL)
- TC 5.2 Publications**
Mon, 9:30 am–10:30 am, Conference Room L (SL)
- TC 5.2 Vision**
Mon, 10:30 am–11:00 am, Conference Room L (SL)
- TC 5.3 Room Air Distribution (30/30) Screen/E**
Tue, 1:00 pm–3:30 pm, Gramercy West (H2)
- TC 5.3 Handbook (20/20) Screen/E**
Fri, 8:00 am–5:00 pm, Gramercy East (H2)
- TC 5.3 Handbook (20/20) Screen/E**
Sat, 8:00 am–3:00 pm, Concourse H (HC)
- TC 5.3 Fan Coils (30/20) Screen/E**
Sun, 8:30 am–9:30 am, Riverside Suite (S3)
- TC 5.3 Chilled Beams (30/20) Screen/E**
Sun, 9:30 am–10:30 am, Riverside Suite (S3)
- TC 5.3 Research (30/20) Screen/E**
Sun, 10:30 am–12:00 pm, Riverside Suite (S3)
- TC 5.3 Research/Handbook/Program (30/20) Screen/E**
Sun, 12:00 pm–2:00 pm, Riverside Suite (S3)
- TC 5.3 Underfloor Air Distribution (11/6)**
Tue, 8:00 am–10:00 am, Hudson (H4)
- TC 5.4 Industrial Process Air Cleaning (11/6)**
Mon, 2:15 pm–4:15 pm, Conference Room B (SL)
- TC 5.5 Air-to-Air Energy Recovery (22/4)**
Tue, 3:30 pm–6:00 pm, Concourse D (HC)
- TC 5.5 Handbook, Program, Research, Standards (10/2)**
Mon, 4:15 pm–6:30 pm, Executive Boardroom (SL)
- TC 5.6 Control of Fire & Smoke (23/30)**
Mon, 4:15 pm–6:30 pm, Madison (H2)
- TC 5.6 Program (12/4)**
Sun, 3:00 pm–4:00 pm, Conference Room B (SL)
- TC 5.6 Research**
Sun, 4:00 pm–5:30 pm, Conference Room B (SL)
- TC 5.6 Handbook**
Sun, 5:30 pm–7:00 pm, Conference Room B (SL)
- TC 5.7 Evaporative Cooling (20/10)**
Mon, 4:15 pm–6:30 pm, Conference Room C (SL)
- TC 5.7 Programs, Handbook, Research**
Sun, 3:00 pm–5:00 pm, Sutton North
- TC 5.8 Industrial Ventilation Systems (20/5)**
Mon, 4:15 pm–6:30 pm, Petit Trianon (H3)
- TC 5.8 Ventilation of Hazardous Spaces (5/5)**
Sun, 7:00 pm–9:00 pm, Midtown (H4)
- TC 5.9 Enclosed Vehicular Facilities (30/10)**
Tue, 3:30 pm–6:00 pm, Concourse E (HC)
- TC 5.9 Program, Handbook, Research**
Tue, 1:00 pm–3:30 pm, Concourse E (HC)
- TC 5.10 Kitchen Ventilation (15/10) Screen**
Mon, 10:00 am–12:00 pm, Conference Room K (SL)
- TC 5.10 Handbook 15/10) Screen**
Sun, 8:00 am–10:00 am, Clinton (H2)
- TC 5.10 Research**
Sun, 10:00 am–12:00 pm, Clinton (H2)
- TC 5.10 Program**
Mon, 8:00 am–9:00 am, Conference Room K (SL)
- TC 5.10 Codes & Standards**
Mon, 9:30 am–10:00 am, Conference Room K (SL)
- TC 5.11 Humidifying Equipment (10/3)**
Mon, 2:15 pm–4:15 pm, Madison 5 (S5)
- TC 5.11 Handbook (6/2) Screen/E**
Sun, 10:00 am–12:00 pm, Holland (H4)
- TC 5.11 Research (8/2) Screen/E**
Sun, 3:00 pm–5:00 pm, Beekman (H2)
- TC 6.1 Hydronic & Steam Htg. Equip & Sys (20/25)**
Tue, 1:00 pm–3:30 pm, Madison (H2)
- TC 6.1 Handbook (12/15)**
Sun, 5:00 pm–7:00 pm, Conference Room E (SL)
- TC 6.1 Chilled Water Plant (12/15)**
Sun, 7:00 pm–8:00 pm, Conference Room E (SL)
- TC 6.1 Program (12/15)**
Mon, 2:15 pm–3:15 pm, Madison 6 (S5)
- TC 6.1 Research (12/15)**
Mon, 3:15 pm–4:15 pm, Madison 6 (S5)
- TC 6.2 District Energy (20/10)**
Sponsoring: Seminar 6: Efficient Technologies That Are Also Economically Sustainable, Part 1 of 3: District Energy (DE) and Complementary Options
Sun, 3:00 pm–5:00 pm, Conference Room E (SL)
- TC 6.2 Programs, Research, Handbook (10/5)**
Sun, 1:00 pm–3:00 pm, Conference Room E (SL)
- TC 6.3 Central Forced Air Htg. & Cooling Sys (20/12)**
Tue, 1:00 pm–3:30 pm, Clinton (H2)
- TC 6.5 Radiant Heating and Cooling (17/10)**
Sponsoring: Seminar 33: Optimized Control Strategies for Chilled Beams and Radiant Panels
Mon, 2:15 pm–4:15 pm, Concourse F (HC)
- TC 6.5 Research, Spec Pubs, Journal, Program, Handbook (8/20)**
Sun, 3:00 pm–5:00 pm, Sutton Center (H2)
- TC 6.5 RP-1383**
Sun, 5:00 pm–6:00 pm, Sutton Center (H2)
- TC 6.6 Service Water Heating Systems (18/15)**
Mon, 4:15 pm–6:30 pm, Conference Room D (SL)
- TC 6.6 Research/Program (18/15)**
Mon, 2:15 pm–4:15 pm, Conference Room D (SL)

TC 6.7 Solar Energy Utilization (20/10) Screen
Tue, 1:00 pm–3:30 pm, Conference Room K (SL)

TC 6.7 Research/Standards (5/5)
Mon, 2:15 pm–4:15 pm, Conference Room G (SL)

TC 6.7 Program
Mon, 4:15 pm–6:30 pm, Conference Room G (SL)

TC 6.7 Handbook
Mon, 6:30 pm–8:30 pm, Conference Room G (SL)

TC 6.8 Geothermal Heat Pump and Energy Recovery Applications (16/25)

Sponsoring: Seminar 58: Using System EER/COP to Reasonably Model GSHP System Performance

Tue, 3:30 pm–6:30 pm, Gramercy West (H2)

TC 6.8 Handbook Subcommittee (10/5)
Sat, 12:00 pm–3:00 pm, Conference Room A (SL)

TC 6.8 Program/Handbook/Research (15/0)
Sun, 5:00 pm–7:00 pm, Rendezvous Trianon (H3)

TC 6.9 Thermal Storage (15/10) Screen/E

Sponsoring: Seminar 6: Efficient Technologies That Are Also Economically Sustainable, Part 1 of 3: District Energy (DE) and Complementary Options, Seminar 16 Efficient Technologies That Are Also Economically Sustainable, Part 2 of 3: Combined Heat & Power (CHP) and Complementary Options, Seminar 17: Efficient Technologies That Are Also Economically Sustainable, Part 3 of 3: Thermal Energy Storage (TES) and Complementary Options and Workshop 7: Panel Discussion: Why Aren't You Using Thermal Energy Storage? Dispelling the Myths and Discussing the Realities of TES Integration and Cost Savings

Mon, 4:30 pm–6:00 pm, Lincoln (H4)

TC 6.9 Standards (15/10) Screen/E
Mon, 2:15 pm–2:40 pm, Lincoln (H4)

TC 6.9 Program (15/10) Screen/E
Mon, 2:40 pm–3:10 pm, Lincoln (H4)

TC 6.9 Handbook, (15/10) Screen/E
Mon, 3:10 pm–3:30 pm, Lincoln (H4)

TC 6.9 LRP /Website (15/10) Screen/E
Mon, 3:30 pm–3:50 pm, Lincoln (H4)

TC 6.9 Research (15/10)
Mon, 3:50 pm–4:10 pm, Lincoln (H4)

TC 6.10 Fuels & Combustion (20/10)
Tue, 3:30 pm–6:00 pm, Bryant (H2)

TC 6.10 Handbook (10/10) Screen
Mon, 2:15 pm–4:15 pm, Hilton Boardroom (H4)

TC 7.1 Integrated Building Design (25/10) Electric

Sponsoring: Seminar 19: Energy Efficient Single Pipe Hydronic System Design for Large and Tall Buildings, Seminar 51: DOE's Building Energy Efficient Buildings Hub's Findings and the Future of Equipment and System Design Applied to Building Retrofits, and Seminar 5: Design to Ensure Building Performance with a Comprehensive M&V Process: A LEED Platinum Case Study

Mon, 8:15 am–10:30 am, Concourse E (HC)

TC 7.1 Subcommittees Electric
Sun, 5:00 pm–7:00 pm, Sutton North (H2)

TC 7.2 HVAC Construction and Design Build Technology (10/5)

Sun, 10:00 am–12:00 pm, Hilton Boardroom (H4)

TC 7.3 Operations & Maintenance Management (25/7) E

Sponsoring: Seminar 59: Project Delivery from Design to Operation: The Good, the Bad, and the Ugly

Tue, 1:00 pm–3:30 pm, Concourse D (HC)

TC 7.3 Standards/Program (20/0) E
Mon, 2:15 pm–4:15 pm, Conference Room A (SL)

TC 7.3 Research/Handbook/Education & Training
Mon, 4:15 pm–6:30 pm, Conference Room A (SL)

TC 7.3 PMS 1609 (5/3)
Mon, 8:00 am–10:00 am, Conference Room A (SL)

TC 7.4 Exergy Analysis for Sustainable Buildings (14/8)
Sun, 8:00 am–10:00 am, Conference Room K (SL)

TC 7.5 Smart Building Systems (16/24) Screen

Sponsoring: Forum 1: Value for Smart Meters for Building Operation and Consumers, Seminar 31: Intelligent Building Operations Workshop Results: Fault Detection and Diagnostics, Seminar 61: Using Smart Meters to Charge Up Building Energy Efficiency, and Seminar 15: Fault Detection, Diagnostics and Control for Packaged Commercial Rooftop and Split Residential Units: What's New?

Tue, 3:30 pm–6:00 pm, Madison (H2)

TC 7.5 Fault Detection & Diagnosis (20/20) Screen
Sun, 3:00 pm–3:45 pm, Riverside Ballroom (S3)

TC 7.5 Enabling Technologies
Sun, 3:45 pm–4:30 pm, Riverside Ballroom (S3)

TC 7.5 Smart Grid
Sun, 4:30 pm–5:15 pm, Riverside Ballroom (S3)

TC 7.5 Handbook
Sun, 5:15 pm–6:15 pm, Riverside Ballroom (S3)

TC 7.5 Buildings Operations Dynamics (20/20) Screen
Mon, 4:00 pm–4:45 pm, Riverside Ballroom (S3)

TC 7.5 Research
Mon, 4:45 pm–5:45 pm, Riverside Ballroom (S3)

TC 7.6 Building Energy Performance (20/30) Screen
Tue, 1:00 pm–3:30 pm, Concourse G (HC)

TC 7.6 Federal Bldgs.
Sun, 9:00 am–12:00 pm, Executive Boardroom (SL)

TC 7.6 Research
Sun, 1:00 pm–2:00 pm, Hudson (H4)

TC 7.6 Commercial Building Energy Audit
Sun, 2:00 pm–3:00 pm, Hudson (H4)

TC 7.6 Handbook
Sun, 3:00 pm–4:00 pm, Hudson (H4)

TC 7.6 Monitoring & Energy Performance (10/10)
Mon, 2:15 pm–4:15 pm, Madison 4 (S5)

TC 7.6 Energy Management
Mon, 4:15 pm–5:15 pm, Madison 4 (S5)

TC 7.6 Standards
Mon, 5:15 pm–6:15 pm, Madison 4 (S5)

TC 7.6 Executive
Mon, 6:15 pm–6:45 pm, Madison 4 (S5)

TC 7.7 Testing & Balancing (20/30)
Mon, 2:15 pm–4:15 pm, Mercury Ballroom (H3)

TC 7.7 Program/Handbook (12/8)
Sat, 12:00 pm–3:00 pm, Hudson (H4)

TC 7.8 Owning & Operating Costs (20/5)
Mon, 2:15 pm–4:15 pm, Harlem (H4)

TC 7.8 Program, Handbook, Research (6/6)
Sun, 3:00 pm–5:00 pm, Park 4 (S5)

TC 7.9 Building Commissioning (20/50)

Sponsoring: Seminar 25: Effective Best Practices for Successful Building Systems Commissioning, AHR Expo Session 1: Trends in Building Energy Disclosure: Increasing Energy Efficiency without Retrofits

Sun, 3:00 pm–5:00 pm, Gramercy East (H2)

TC 7.9 Handbook (6/0)

Sat, 8:00 am–9:00 am, Conrad Hilton Suite (H4)

TC 7.9 Research (10/0)

Sat, 9:00 am–10:30 am, Conrad Hilton Suite (H4)

TC 7.9 Program (15/0)

Sun, 9:00 am–10:30 am, Madison 6 (S5)

TC 8.1 Positive Displacement Compressors (12/14)

Tue, 3:30 pm–6:00 pm, Concourse H (HC)

TC 8.1 Research (6/2)

Mon, 2:15 pm–4:15 pm, Park 4 (S5)

TC 8.2 Centrifugal Machines (20/8)

Mon, 2:15 pm–4:15 pm, Conference Room K (SL)

TC 8.2 Research and Program

Sun, 5:00 pm–7:00 pm, Concourse H (HC)

TC 8.2 Handbook

Sun, 7:00 pm–8:00 pm, Concourse H (HC)

TC 8.3 Absorption and Heat Operated Machines (20/10)

Mon, 3:30 pm–6:00 pm, Holland (H4)

TC 8.3 Research/Handbook (8/8)

Mon, 2:15 pm–3:30 pm, Holland (H4)

TC 8.4 Air-to-Refrigerant Heat Transfer Equip (20/10) Screen/E

Sponsoring: Seminar 11: Heat Exchanger Designs for Lower GWP Refrigerants

Tue, 3:30 pm–6:00 pm, Concourse G (HC)

TC 8.4 Research and Standards (15/15) Screen/E

Mon, 6:30 pm–9:30 pm, Concourse D (HC)

TC 8.5 Liquid to Refrigerant Heat Transfer (25/10)

Mon, 4:15 pm–6:30 pm, Conference Room K (SL)

TC 8.5/1.3 Research

Sun, 3:00 pm–7:00 pm, Rendezvous Trianon (H3)

TC 8.6 Cooling Towers and Evaporative Condensers (10/10)

Mon, 2:15 pm–4:15 pm, Concourse H (HC)

TC 8.6 Handbook/Program/Research (10/4)

Mon, 8:00 am–10:00 am, Concourse F (HC)

TC 8.7 Variable Refrigerant Flow (20/30)

Mon, 4:15 pm–6:30 pm, Mercury Ballroom (H3)

TC 8.8 Refrigerant System Controls & Accessories (10/10) Screen

Tue, 1:00 pm–3:30 pm, Bryant (H2)

TC 8.9 Residential Refrigerators and Food Freezers (6/10)

Sponsoring: Seminar 50: Developments in Refrigerator Standards

Mon, 2:15 pm–4:15 pm, Sutton Center

TC 8.10 Mechanical Dehumidifiers & Heat Pipes (8/20)

Tue, 3:30 pm–6:00 pm, Madison 4 (S5)

TC 8.10 Program/Handbook/Research/Standards

Tue, 1:00 pm–3:30 pm, Madison 4 (S5)

TC 8.11 Unitary and Room Air Conditioners & Heat Pumps (20/30)

Sponsoring: Technical Paper Session 5: Advanced Residential HVAC System Studies: Humidity Control Options, Solar PV Integration, and Multi-function Integration

Mon, 4:15 pm–6:30 pm, Clinton (H2)

TC 8.11 Handbook/Program/Research (10/10)

Sun, 3:00 pm–6:00 pm, Madison 5 (SL)

TC 8.12 Desiccant Dehumidification Equipment and Components (15/15)

Mon, 2:15 pm–4:15 pm, Petit Trianon (H3)

TC 9.1 Large Building Air-Conditioning Systems (23/5)

Tue, 1:00 pm–3:30 pm, Gibson (H2)

TC 9.1 Research/Program/Handbook

Tue, 1:00 pm–3:30 pm, Gibson (H2)

TC 9.2 Industrial Air Conditioning (25/10) Screen

Tue, 1:00 pm–3:30 pm, Gramercy East (H2)

TC 9.2 Program/Research/Handbook

Sun, 4:00 pm–7:00 pm, Madison 6 (S5)

TC 9.2 Nuclear (15/5)

Mon, 2:15 pm–4:15 pm, Conference Room C (SL)

TC 9.3 Transportation Air Conditioning (25/20)

Mon, 3:30 pm–6:00 pm, Riverside Suite (S3)

TC 9.3 Handbook (5/5)

Sun, 3:00 pm–4:00 pm, Concourse B (HC)

TC 9.3 Aviation (15/15) Screen

Sun, 4:00 pm–6:00 pm, Concourse B (HC)

TC 9.3 Automotive (15/15) Screen

Sun, 5:00 pm–7:00 pm, Concourse E (HC)

TC 9.3 Research (10/10)

Mon, 2:15 pm–3:30 pm, Riverside Suite (S3)

TC 9.3 RP 1603 (8/4) Screen

Mon, 8:00 am–10:00 am, Hilton Boardroom (H4)

TC 9.4 Justice Facilities (20/5)

Sun, 8:00 am–10:00 am, Concourse F (HC)

TC 9.6 Health Care Facilities (20/60) Screen

Sponsoring: Seminar 53: Hospital Building Performance: More for Less

Sun, 5:00 pm–7:00 pm, Mercury Ballroom (H3)

TC 9.6 Infectious Diseases (20/25) Screen

Sun, 10:00 am–12:00 pm, New York (H4)

TC 9.6 Research (20/5) Screen

Sun, 12:30 pm–2:30 pm, New York (H4)

TC 9.6 Energy (20/5) Screen

Sun, 2:30 pm–4:00 pm, New York (H4)

TC 9.6 Program (20/0)

Sun, 4:00 pm–5:00 pm, New York (H4)

TC 9.7 Educational Facilities (13/10)

Sun, 1:00 pm–3:00 pm, Conference Room C (SL)

TC 9.8 Large Building Air-Conditioning Applications (20/10)

Mon, 2:15 pm–4:15 pm, Conference Room L (SL)

TC 9.8 Handbook/Research/Program (20/6)

Mon, 9:00 am–12:00 pm, Lincoln (H4)

TC 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment (25/50) (Screen)

Sponsoring: Seminar 4: CFD for Data Center Applications Part I—Modeling Advancements, Seminar 47: A Look at DCIM Solutions and Their Integration Challenges in Today's Data Centers and a Look at What Tomorrow Offers, and Technical Paper Session 1: Hydraulic Modeling as a Tool to Enable Design Resiliency and Quantify Pump Energy Savings for Data Center Chilled Water Systems

Mon, 2:15 pm–9:30 pm, Gramercy East (H2)

TC 9.9 Program/ Handbook/ Research (15/25) Screen
Sun, 5:00 pm–7:00 pm, Morgan (H2)

TC 9.10 Laboratory Systems (20/50) Screen/E

Sponsoring: Seminar 24: Vital Information Input for Your BAS to Make the Laboratory Environment Safer and More Energy Efficient, Workshop 1: Chemical Laboratories Classification to Improve Safety and Energy Efficiency

Tue, 3:30 pm–6:00 pm, Mercury Ballroom (H3)

TC 9.10 Standards (10/10) Screen/E
Sun, 3:00 pm–3:45 pm, Midtown (H4)

TC 9.10 Research
Sun, 3:45 pm–4:30 pm, Midtown (H4)

TC 9.10 Program
Sun, 4:30 pm–5:15 pm, Midtown (H4)

TC 9.10 Lab Classification
Sun, 5:15 pm–6:00 pm, Midtown (H4)

TC 9.10 Design Guide (10/10) Screen/E
Tue, 1:00 pm–2:30 pm, Mercury Ballroom (H3)

TC 9.10 Handbook
Tue, 2:30 pm–3:30 pm, Mercury Ballroom (H3)

TC 9.11 Clean Spaces (30/45)

Mon, 2:15 pm–4:00 pm, Morgan (H2)

TC 9.11 Cleanroom Energy Efficiency (10/10)
Mon, 4:00 pm–5:00 pm, Morgan (H2)

TC 9.11 Handbook
Mon, 5:00 pm–5:30 pm, Morgan (H2)

TC 9.11 Design Guide
Mon, 5:30 pm–6:00 pm, Morgan (H2)

TC 9.12 Tall Buildings (12/5)

Sponsoring: Seminar 30: Current Trends in Tall Building Designs, Seminar 39: Specific Engineering Solutions for Tall Buildings, Seminar 40: ASHRAE and Tall Buildings, Seminar 45: Life Safety Issues with Tall Buildings, Seminar 46: Natural Ventilation for Tall Buildings, Workshop 5: Is ASHRAE Tall Enough for Tall Buildings?

Tue, 3:30 pm–6:00 pm, Madison 5 (S5)

TC 10.1 Custom Engineered Refrig Systems (20/10)

Mon, 2:15 pm–4:15 pm, Clinton (H2)

TC 10.1 Cryogenic Refrigerants (10/10)
Sun, 3:00 pm–5:00 pm, Madison (H2)

TC 10.1 Research/Handbook, Standards/ Program (30/10)
Sun, 5:00 pm–7:00 pm, Madison (H2)

TC 10.2 Automatic Ice Making Plants/Skating Rinks (12/3)

Mon, 4:15 pm–6:30 pm, Madison 5 (S5)

TC 10.2 Research/Handbook (3/2)
Mon, 8:00 am–10:00 am, Conference Room G (SL)

TC 10.3 Refrigerant Piping, Controls and Accessories (20/10)

Tue, 1:00 pm–3:30 pm, Concourse H (HC)

TC 10.5 Refrigeration Distrib and Storage Facilities (15/10)
Tue, 3:30 pm–6:00 pm, Conference Room L (SL)

TC 10.6 Transport Refrigeration (8/10)
Mon, 4:45 pm–7:00 pm, Madison 2 (S5)

TC 10.6 Handbook
Mon, 2:15 pm–3:00 pm, Madison 2 (S5)

TC 10.7 Commercial Food and Beverage Refrigeration Equipment (25/25)

Mon, 2:15 pm–4:15 pm, Riverside Ballroom (S3)

TC 10.7 Program (15/15)
Sun, 5:15 pm–6:00 pm, New York (H4)

TC 10.7 Research
Sun, 6:00 pm–6:45 pm, New York (H4)

TC 10.7 Handbook
Sun, 6:45 pm–7:30 pm, New York (H4)

TC 10.8 Refrigeration Load Calculations (10/10)
Sun, 3:00 pm–5:00 pm, Conference Room C (SL)

Task Groups (TG), Technical Resource Groups (TRG), and Multidisciplinary Task Groups (MTG)

TG1.Optimization (10/5)

Sponsoring: Seminar 32: Optimization Techniques in HVAC, Seminar 55: Application of Dynamic Optimization to Smart Building Systems

Sun, 1:00 pm–3:00 pm, Concourse F (HC)

TG2.HVAC Security (20/6)

Tue, 9:00 am–12:00 pm, Holland (H4)

TRG4 Sustainable Building Guidance & Metrics (17/10)
Sat, 1:00 pm–3:00 pm, Concourse C (HC)

TRG4.IAQP (12/8)

Sun, 10:30 am–12:30 pm, Conference Room K (SL)

MTG Energy Efficiency Classification of General Ventilation Air-Cleaning Devices (15/5)

Tue, 8:00 am–12:00 pm, Lincoln (H4)

MTG Building Information Modeling

Sat, 1:00 pm–3:00 pm, Conference Room L (SL)

MTG Energy Targets Multidisciplinary Task Group (10/0)

Sponsoring: Workshop 8: Performance-based Codes and Standards: Catalyst for Energy Efficiency Retrofits in the 21st Century?

Tue, 1:00 pm–3:00 pm, Conrad Hilton Suite (H4)

MTG Hot Climate Design Guide Planning Meeting (20/20)

Wed, 12:30 pm–2:00 pm, Gramercy East (H2)

MTG Cold Climate Design Guide

Wed, 2:00 pm–3:00 pm, Gramercy East (H2)

Cold Climate Guide Workshop

Wed, 3:00 pm–5:00 pm, Gramercy East (H2)

Standard Project Committee (SPC) and Standing Standard Project Committee (SSPC)

SPC Chair Training Breakfast

Sun, 7:00 am–9:00 am, Petit Trianon (H3)

SSPC 15 Safety Standards for Refrigeration Systems (18/30) Screen

Sun, 8:00 am–5:00 pm, Morgan (H2)

SPC 16/58 MOT/Rating Room Air Conditioners and PTAC/PTHP (5/5) Screen/E

Tue, 8:00 am–12:00 pm, Conference Room D (SL)

SPC 17 MOT/Capacity of TEV's (5/3) Screen/E

Sun, 5:00 pm–7:00 pm, Hilton Boardroom (H4)

SPC 20 MOT/Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers (7/5) Screen/E

Sun, 12:00 pm–2:00 pm, Madison 5 (S5)

SPC 22 MOT/Water-cooled Refrigerant Condensers (7/10)

Sun, 9:00 am–12:00 pm, Madison 4 (S5)

SPC 23.1 MOT/for Performance Rating Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant (9/6) Screen/E

Mon, 2:15 pm–4:15 pm, Sutton North (H2)

SPC 23.2 MOT/Rating Positive Displacement Compressors that Operate at Supercritical Temperatures of the Refrigerant (7/5)

Mon, 10:00 am–12:00 pm, Conference Room A (SL)

SPC 29 MOT/Automatic Ice Makers (12/8)

Mon, 4:15 pm–7:15 pm, Conference Room B (SL)

SPC 30 MOT Liquid Chilling Packages (7/10) Screen

Mon, 8:00 am–11:00 am, Concourse H (HC)

SPC 32.1 MOT for Rating Vending Machines for Sealed Beverages (15/5)

Sun, 10:30 am–1:00 pm, Madison 3 (S5)

SSPC 34 Designation & Safety Class. of Refrig. (30/20) Screen/E

Mon, 6:30 pm–10:00 pm, Mercury Ballroom (H3)

SSPC 34 Designation Nomenclature (10/10) Screen/E

Sat, 7:00 am–10:00 am, Concourse B (HC)

SSPC 34 Flammability (15/20) Screen/E

Sat, 10:00 am–3:00 pm, Concourse B (HC)

SSPC 34 Toxicity (10/20) Screen/E

Sun, 6:30 pm–10:00 pm, Clinton (H2)

SPC 37 MOT for Rating Electrically Driven Unitary Air-Conditioners and Heat Pump Equipment (7/12) Screen/E

Wed, 8:00 am–10:00 am, Gibson (H2)

SSPC 41 Standard Methods for Measurement (15/10)

Sun, 1:00 pm–4:00 pm, Conference Room F (SL)

SSPC 41.2 Laboratory Airflow-Standard Method for Laboratory Airflow Measurement (10/5)

Mon, 8:00 am–12:00 pm, Madison 6 (S5)

SSPC 41.7 Standard Methods for Gas Flow Measurement (10/5)

Tue, 8:00 am–10:00 am, Concourse C (HC)

SSPC 41.8 Standard Methods for Liquid Flow Measurement (10/5)

Tue, 10:00 am–12:00 pm, Concourse C (HC)

SPC 51 Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating (15/10) Screen/Flipchart

Sun, 12:30 pm–3:00 pm, Madison 4 (S5)

SSPC 52.2P MOT/Part Size Eff. Proc. for Testing Air Cleaning Devices (20/40) Screen

Sat, 8:00 am–12:00 pm, New York (H4)

SSPC 55 Thermal Env Cond. for Human Occupancy (23/6) Screen

Sat, 8:00 am–3:00 pm, East (H4)

Sun, 9:00 am–12:00 pm, Conference Room J (SL)

SSPC 62.1 Ventilation and Acceptable IAQ in Commercial, Institutional and High-Rise Residential Buildings (30/30) Screen/E

Sat, 9:00 am–3:00 pm, Rendezvous Trianon (H3)

SSPC 62.1 Ventilation and Acceptable IAQ in Commercial, Institutional and High-Rise Residential Buildings

Sun, 1:00 pm–7:00 pm, Murray East/West (H2)

SSPC 62.1 Education Subcommittee (15/15) Screen

Fri, 1:00 pm–5:00 pm, Sutton North (H2)

SSPC 62.1 Administration Subcommittee (15/15) Screen

Fri, 1:00 pm–5:00 pm, Sutton Center (H2)

SSPC 62.2 Ventilation and Acceptable IAQ in Low-Rise Residential Buildings (28/13) Screen/E

Fri, 1:00 pm–2:30 pm, Beekman (H2)

Sat, 8:30 am–3:00 pm, Concourse G (HC)

SSPC 62.2 IAQ Subcommittee (12/20) Screen

Fri, 9:00 am–12:00 pm, Concourse C (HC)

SSPC 62.2 IAQ Subcommittee

Fri, 2:30 pm–5:00 pm, Concourse C (HC)

SSPC 62.2 System Subcommittee

Fri, 2:30 pm–5:00 pm, Concourse D (HC)

SSPC 62.2 Envelope Subcommittee

Fri, 2:30 pm–5:00 pm, Concourse H (HC)

SPC 63.1 MOT/Liquid-Line Refrigerant Driers (5/5)

Sun, 3:00 pm–4:00 pm, Hilton Boardroom (H4)

SPC 72 MOT/Commercial Refrigerators and Freezers (9/12)

Sun, 1:00 pm–5:00 pm, Madison 3 (S5)

SPC 79 Room Fan Coil Standard Committee (6/10) Screen/E

Sat, 8:00 am–12:00 pm, Harlem (H4)

SPC 84-2008 MOT/Air-to-Air Heat/Energy Exchangers (10/4)

Tue, 8:00 am–12:00 pm, Conference Room B (SL)

SSPC 90.1 Energy Eff. Design of New Bldg. (50/60) Screen/E

Sat, 8:00 am–12:00 pm, Murray East/West (H2)

Sun, 9:00 am–12:00 pm, Murray East/West (H2)

Mon, 8:00 am–12:00 pm, Murray East/West (H2)

SSPC 90.1 Format & Compliance Subcommittee (4/6) E

Fri, 5:00 pm–10:00 pm, Holland (H4)

Sat, 1:00 pm–5:00 pm, Midtown (H4)

Sun, 4:00 pm–7:00 pm, Concourse D (HC)

SPC 90.1 Mechanical Subcommittee (25/25) Screen/E

Fri, 9:00 am–10:00 pm, Murray Hill East (H2)

Sat, 1:00 pm–7:00 pm, Murray East/West (H2)

Sun, 1:00 pm–8:00 pm, Gibson (H2)

SSPC 90.1 Lighting Subcommittee (12/10) Screen/E

Fri, 9:00 am–10:00 pm, Harlem (H4)

Sat, 1:00 pm–7:00 pm, Madison (H2)

Sun, 1:00 pm–7:00 pm, Concourse C (HC)

SSPC 90.1 ECB Subcommittee (8/10) Screen/E

Fri, 5:00 pm–10:00 pm, East Suite (H4)

Sat, 1:00 pm–5:00 pm, Holland (H4)

Sun, 1:00 pm–4:00 pm, Concourse D (HC)

SSPC 90.1 Envelope Subcommittee (15/30) Screen/E

Fri, 9:00 am–10:00 pm, Gibson (H2)

Sat, 1:00 pm–7:00 pm, Bryant (H2)

Sun, 1:00 pm–7:00 pm, Concourse G (HC)

SSPC 90.1 Users Manual (12/5) E

Sat, 5:00 pm–6:00 pm, Holland (H4)

SSPC 90.2 Energy Eff. Design of New Low Rise Res. Bldg. (29/20) Screen/E

Mon, 2:15 pm – 6:15 pm, Gramercy West (H2)

Tue, 1:00 pm–5:00 pm, New York (H4)

SSPC 90.2 Lighting (4/4) Screen/E

Mon, 6:15 pm–9:15 pm, Harlem (H4)

Tue, 8:00 am–12:00 pm, Concourse B (HC)

SSPC 90.2 Mechanical (6/6) Screen/E

Mon, 6:15 pm–9:15 pm, Hudson (H4)

Tue, 8:00 am–12:00 pm, Concourse H (HC)

SSPC 90.2 Envelope (11/15) Screen/E

Mon, 6:15 pm–9:15 pm, Gramercy West (H2)

Tue, 8:00 am–12:00 pm, New York (H4)

SPC 90.4 Energy Standard for Data Centers and Telecommunications Buildings (25/40) Screen/E

Sat, 9:00 am–1:00 pm, Regent (H2)

Mon, 7:00 am–11:00 am, Madison (H2)

SPC 97 Sealed Glass Tube Method to Test the Chemical Stability of Materials for Use Within Refrigerant Systems

Tue, 9:30 am–11:00 am, Conference Room L (SL)

SPC 100 Energy Efficiency in Existing Buildings (20/30) Screen

Tue, 8:00 am–12:00 pm, Gramercy East (H2)

SPC 103/MOT Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers (14/10)

Sun, 6:00 pm–10:00 pm, Concourse F (HC)

SPC 105 Standard Methods of Measuring and Expressing Building Energy Performance (7/15) Screen

Sun, 9:00 am–12:00 pm, Concourse H (HC)

SPC 110 MOT/Performance of Laboratory Fume Hoods

Tue, 8:00 am–12:00 pm, Conference Room C (SL)

SPC 111 Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation and Air-Conditioning Systems (12) (12/0) Screen/E

Fri, 8:00 am–12:00 pm, Concourse F (HC)

SPC 116 MOT/for Rating Seasonal Efficiency of Unitary Air-Conditioners and Heat Pumps (7/12) Screen/E

Wed, 10:00 am–12:00 pm, Gibson (H2)

SPC 118.1 MOT/Commercial Water Heaters (6/6)

Sun, 9:00 am–12:00 pm, Park 4 (H5)

SPC 118.2R MOT/Rating Residential Water Heaters (22/20)

Tue, 1:00 pm–5:00 pm, Concourse C (HC)

SPC 124 MOT/Rating Combinations Space-Heating and Water Heating Appliances (11/9) Screen/E

Wed, 8:00 am–12:00 pm, Concourse H (HC)

SPC 126 MOT/HVAC Air Ducts

Sun, 8:00 am–10:00 am

SPC 129 Measuring Air Change Effectiveness

Sun, 5:00 pm–7:00 pm

SPC 130 MOT/for Rating Ducted Air Terminal Units (12/15)

Sun, 2:00 pm–6:00 pm, Conference Room J (SL)

SSPC 135 BACnet (15/5)

Thu, 8:00 am–5:00 pm, Concourse B (HC)

SSPC 135 BACnet (20/5)

Fri, 8:00 am–5:00 pm, Concourse B (HC)

SSPC 135 BACnet (20/5)

Fri, 8:00 am–5:00 pm, Concourse E (HC)

SSPC 135 BACnet (45/15)

Sat, 8:00 am–3:00 pm, Trianon Ballroom (H3)

SSPC 135 BACnet Working Group (20/5)

Sun, 8:00 am–5:00 pm, Conference Room H (SL)

SSPC 135 BACnet (20/5)

Sun, 8:00 am–5:00 pm, Conference Room L (SL)

SSPC 135 BACnet (45/15)

Mon, 8:00 am–12:00 pm, Gramercy West (H2)

SPC 139R MOT/for Rating Desiccant Dehumidifiers Utilizing Heat for the Regeneration Process

Mon, 8:00 am–10:00 am

SSPC 140 Standard MOT for Evaluation of Bldg. Energy Analysis Computer Program (12/10) Screen

Mon, 2:15 pm–6:15 pm, Rendezvous Trianon (H3)

SPC 145P Test Methods for Assessing Performance of Gas Phase Air Clean. Equip. (12/15)

Sun, 12:00 pm–3:00 pm, Concourse B (HC)

SPC 147 Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment (10/10) Screen/E

Sun, 6:00 pm–10:00 pm, Holland (H4)

SPC 150 MOT/Performance of Cool Storage Systems (10)

Sun, 5:30 pm–7:00 pm, Conference Room C (SL)

SPC 153 MOT/ for Mass Flow Capacity of Four-Way Refrigerant Reversing Valves (5/3) (5/3) Screen/E

Sun, 5:00 pm–7:00 pm, Hilton Boardroom (H4)

SPC 154 Ventilation for Commercial Cooking Operations (11/10) Screen

Mon, 2:15 pm–6:15 pm, Sutton South (H2)

SPC 155P MOT/Rating Commercial Space Heating Boiler Systems (12/6)

Sun, 1:00 pm–5:00 pm, Harlem (H4)

SSPC 160 Criteria for Moisture Control Design Analysis (17/5) Screen/E

Tue, 8:00 am–12:00 pm, Conference Room K (SL)

SPC 161P Air Quality Within Commercial Aircraft (25/15) Screen

Sun, 1:00 pm–3:00 pm, Gramercy East (H2)

Mon, 8:00 am–12:00 pm, Bryant (H2)

SPC 164.3 MOT/Commercial and Industrial Humidifiers (11/4) Screen

Mon, 9:00 am–11:00 am, East (H4)

SSPC 169 Climatic Data for Building Design Standards (10/5) Screen

Mon, 10:00 am–12:00 pm, Hilton Boardroom (H4)

SSPC 170 Ventilation of Healthcare Facilities (20/30) Screen

Tue, 8:00 am–1:00 pm, Concourse G (HC)

SSPC 170 Healthcare Subcommittee (20/30) Screen

Mon, 4:15 pm–6:15 pm, New York (H4)

SPC 171 MOT/ of Seismic Restraint Devices for HVAC&R Equipment (7/5) (20/10)

Tue, 8:00 am–12:00 pm, Concourse D (HC)

SPC 172P MOT/Insoluble Materials in Synthetic Lubricants And HFC Refrigerant Systems (6/4)

Mon, 8:00 am–12:00 pm, Conference Room B (SL)

SPC 175 Metal Pressure Vessel Testing (5/5)

Mon, 4:15 pm–6:15 pm, Conrad Hilton Suite (H4)

SPC 177P MOT/Fractionation Measurement of Refrigerant Blends (6/8)

Mon, 8:00 am–12:00 pm, Madison 5 (S5)

SPC 179P MOT/Life Testing Positive Displaced Compressors

Sun, 1:00 pm–5:00 pm, Conference Room A (SL)

SPC 181 MOT/Liquid-to-Liquid Heat Exchangers (8/10)

Mon, 9:00 am–12:00 pm, Conference Room C (SL)

SPC 184 MOT/Field Test of Liquid Package Chillers (9/5) Screen

Tue, 8:00 am–12:00 pm, Concourse F (HC)

SPC 185 MOT/UVC Lights for Use in Air Handling Units or Air Ducts to Inactivate Airborne Microorganisms (15/0)

Sun, 12:00 pm–1:00 pm, Conference Room E (SL)

SPC 188 Prevention of Legionellosis Associated with Building Water Systems (22/30)

Tue, 9:00 am–12:00 pm, Petit Trianon (H3)

SPC 188 Prevention of Legionellosis Associated with Building Water Systems (22/30)

Tue, 3:45 pm–6:30 pm, Morgan (H2)

SSPC 189.1 ASHRAE/USGBC/IES Standard for the Design of High-Performance Green Buildings except Low-Rise Residential Buildings (40/40)

Tue, 7:30 am–9:30 am, Murray West (H2)

Wed, 8:00 am–12:00 pm, Gramercy West (H2)

SSPC 189.1 Working Group 6 (Water Use)

Tue, 9:30 am–11:30 am, Murray West (H2)

SSPC 189.1 Working Group 5 (Site Sustainability)

Tue, 12:00 pm–2:00 pm, Murray West (H2)

SSPC 189.1 Working Group 9 (Materials and Resources)

Tue, 2:30 pm–4:30 pm, Murray West (H2)

SSPC 189.1 Working Group 10

Tue, 5:00 pm–7:00 pm, Murray West (H2)

SSPC 189.1 Working Group 7 (Energy Efficiency)

Tue, 9:30 am–12:30 pm, Murray East (H2)

SSPC 189.1 Working Group 7.5

Tue, 1:00 pm–4:00 pm, Murray East (H2)

SSPC 189.1 Working Group 8 (IEQ)

Tue, 4:00 pm–7:00 pm, Murray East (H2)

SPC 189.2 Standard for the Design of High-Performance, Sustainable Low-Rise Residential Buildings (10/0)

Sat, 1:00 pm–2:00 pm, Concourse F (HC)

SPC 189.3 Design, Construction and Operation of High-Performance Green Healthcare Facilities (22/12) Screen

Mon, 8:00 am–12:00 pm, Concourse C (HC)

SPC 189.3 Design, Construction and Operation of High-Performance Green Healthcare Facilities

Mon, 2:15 pm–4:00 pm, Concourse C (HC)

SPC 191 Water Conservation (15/10)

Sun, 9:00 am–11:00 am, Bryant (H2)

SPC 191 Water Conservation (15/10)

Tue, 8:00 am–12:00 pm, Madison 5 (S5)

SPC 194 MOT/Direct-Expansion Ground Source Heat Pumps (5/10)

Sun, 1:00 pm–2:00 pm, Midtown (H4)

SPC 195P MOT/for Airflow Controls (7/3)

Tue, 8:00 am–9:30 am, Madison 2 (S5)

SPC 196P MOT/ Measuring Refrigerant Leak Rates (15/3)

Sun, 6:00 pm–10:00 pm, East (H4)

SPC 197 MOT/Attenuation Characteristics of Vibration Isolators (10/2)

Mon, 4:30 pm–6:30 pm, Sutton North (H2)

SPC 199 MOT/Rating the performance of Industrial Pulse Cleaned Dust Collectors (9/4)

Fri, 1:00 pm–5:00 pm, Concourse F (HC)

SPC 199 MOT/Rating the performance of Industrial Pulse Cleaned Dust Collectors (9/6)

Sun, 8:00 am–12:00 pm, Conference Room C (SL)

SPC 200 MOT/Chilled Beams (15/25) Screen/E

Mon, 8:00 am–12:00 pm, Petit Trianon (H3)

SPC 201P: Facility Smart Grid Information Model (15/15) Screen/E

Mon, 2:15 pm–6:30 pm, Bryant (H2)

SPC 201P: Facility Smart Grid Information Model (15/15) Screen/E

Tue, 8:00 am–12:00 pm, Bryant (H2)

SPC 202 Commissioning Process for Buildings & Systems (15/10)

Mon, 8:00 am–12:00 pm, Conference Room D (SL)

SSPC 203P MOT/Determining Heat Gain of Office Equip. Used in Buildings (10/4) Screen

Sat, 11:00 am–3:00 pm, Hilton Boardroom (H4)

SPC 204P MOT/Rating Micro Combined Heat and Power Devices (13/7)

Mon, 6:30 pm–8:30 pm, Concourse C (HC)

SPC 205 Standard Representation of Performance Simulation Data for HVAC&R and Other Facility Equipment (20/20) Screen/E

Tue, 8:00 am–11:00 am, Clinton (H2)

SPC 205 Standard Representation of Performance Simulation Data for HVAC&R and Other Facility Working Group (20/5) Screen/E

Sun, 9:00 am–12:00 pm, Conference Room F (SL)

SPC 207P Laboratory Method of Test of Fault Detection and Diagnostics Applied Commercial Air-Cooled Packaged Systems (20/20) Screen

Mon, 8:00 am–10:00 am, Riverside Suite (S3)

SPC 207 Airflow Working Group (10/0) Screen

Mon, 10:00 am–12:00 pm, Riverside Suite (S3)

SPC 207 Economizer Working Group (10/0) Screen

Mon, 4:30 pm–6:30 pm, Beekman (H2)

SPC 207 Refrigerant Working Group (10/0) Screen
Mon, 6:30 pm–8:30 pm, Beekman (H2)

SPC 209 Energy Simulation Aided Design (30/20) Screen
Mon, 2:15 pm–6:15 pm, Concourse G (HC)

SPC 209 Predesign Subcommittee (10/5) Screen
Sun, 6:00 pm–10:00 pm, Hudson (H4)

SPC 209 Design Development/Construction Documents (10/5) Screen
Sun, 6:00 pm–10:00 pm, Conrad Hilton Suite (H4)

SPC 209 Construction/Commissioning/As-Built/Operation (10/5) Screen
Sun, 6:00 pm–10:00 pm, Bryant (H2)

SPC 209 Resources/References/Definitions Subcommittee (10/5) Screen
Mon, 8:00 am–12:00 pm, Madison 3 (S5)

SPC 209 Conceptual design/Schematic design (10/5) Screen
Mon, 8:00 am–12:00 pm, Madison 4 (S5)

SPC 210 MOT/for Rating Commercial Walk-in Refrigerators and Freezers (3/24)
Mon, 8:00 am–12:00 pm, Executive Boardroom (SL)

SPC 211 Commercial Building Energy Audits (22/15) Screen/E
Mon, 8:00 am–12:00 pm, Gramercy East (H2)

SPC 212 Evaporative Pre-Cooler Test Standard (6/5)
Tue, 8:00 am–12:00 pm, Madison 4 (S5)

SPC 213P Method of Calculating Moist Air Thermodynamics (5/3) E
Tue, 8:00 am–10:00 am, Midtown (H 4)

SGPC 0-General Commissioning Process (17/10)
Sat, 8:00 am–12:00 pm, Conference Room L (SL)

GPC 1.2 Commissioning Process for Existing HVAC&R Systems (22/10) Screen/E
Fri, 8:00 am–3:00 pm, Lincoln (H4)

GPC 1.3 Building Operation and Maintenance Training for the HVAC&R Commissioning Process (10/5)
Tue, 1:00 pm–5:00 pm, Conference Room B (SL)

GPC 1.4 Systems Manual Preparation for the Commissioning Process (8/4)
Sat, 1:00 pm–3:00 pm, Conference Room B (SL)

GPC 6, Refrigerant Information Recommended (6/3) Screen
Sun, 12:00 pm–1:00 pm, Madison (H2)

SGPC 10 Interaction Affecting the Achievement of Acceptable Indoor Environments (12/8) Screen
Sun, 8:00 am–12:00 pm, Madison 5 (S5)

GPC 11 Field Testing of HVAC Controls Components (7/3) Screen/E
Sat, 9:00 am–12:00 pm, Hudson (H4)

SGPC 13 Guideline for Specifying Direct Digital Control Systems (11/6) Screen
Sat, 9:00 am–1:00 pm, Conference Room C (SL)

GPC 14 Measuring Energy Demand and Water (9/5) Screen
Sun, 6:00 pm–10:00 pm, Concourse B (HC)

SGPC 20 Documenting HVAC&R Work Processes and Data Exchange Requirements (7/7)
Mon, 10:15 am–12:15 pm, Concourse F (HC)

GPC 23 Guideline for the Design/Application of HVAC Equip. for Rail Passenger Vehicles (10/3) Screen
Mon, 8:00 am–12:00 pm, Holland (H4)

GPC 23 Guideline for the Design/Application of HVAC Equip. for Rail Passenger Vehicles (10/3) Screen
Tue, 8:00 am–12:00 pm, Concourse E (HC)

GPC 27P Procedures for Measurement of Gases in Indoor Environments (5/5) Flipchart
Sun, 3:00 pm–5:00 pm, Conrad Hilton Suite (H4)

GPC 34P Energy Guideline for Historical Buildings and Structures (12/0)
Tue, 7:00 am–9:00 am, Harlem (H4)

GPC 35 Method for Determining the Energy Consumption Caused By Air-Cleaning and Filtration Devices (11/30) Screen
Tue, 8:00 am–10:00 am, Gibson (H2)

US TAG to ISO/TC 86 (20) Screen
Mon, 8:00 am–10:00 am, Clinton (H2)

US TAG to ISO/TC 142 (30/10) Screen
Sat, 2:30 pm–3:15 pm, Concourse E (HC)

US TAG to ISO/TC 205 (20/0) Screen
Tue, 12:30 pm–2:00 pm, Concourse F (HC)

USNC/IIR (20/10)
Tue, 2:00 pm–4:00 pm, Lincoln (H4)

USNT/IEA (20/10)
Tue, 4:00 pm–6:00 pm, Lincoln (H4)

Thermal Performance of the Exterior Envelopes of Whole Buildings (30/0)
Mon, 9:00 am–12:00 pm, Morgan (H2)

gbXML (10/0)
Tue, 12:00 pm–1:00 pm, Madison 3 (S5)

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