THE HOT AIR DIFFUSER

Chapter Newsletter

NOVEMBER/DECEMBER 2012 Volume 19 Issue 3

ASHRAE Idaho Chapter

PRESIDENT'S MESSAGE

Hello fellow ASHRAE members,

I hope you all had a wonderful Thanksgiving! It's hard to believe we are already in December! 2012 will be history before we know it! I would like to thank Russ Pratt for planning another successful meeting last month. We were proud to host ASHRAE distinguished lecturer Devin Abellon who gave a great talk on radiant cooling technologies, and we received great feedback from those who attended. The weather is cooling down, and snow is just around the corner; we all look forward to the holidays, spending time with family, friends, and enjoying all of Idaho's great winter activities. I wish all of you a Merry Christmas and a happy new year!

Thank you,
Randy R. Reed
Idaho ASHRAE President

INSIDE THIS ISSUE:

DECEMBER PROGRAM*

When: **WEDNESDAY, Dec. 12**
11:45AM-1:00PM

Where: **Idaho Power Building**
1221 W. Idaho St.
Boise, Idaho 83702

The speaker for this month's chapter meeting will be David L. Curtis, P.E., Executive Director of the Idaho Board of Professional Engineers. He will be joining us for a discussion of the proposed "Masters or Equivalent" requirements for state P.E. Licensure.

In 2006, the National Council of Examiners for Engineers and Surveyors (NCEES) adopted a change to the Model Law for professional engineers to require that, for an individual to be licensed by a state as a Professional Engineer (PE) in 2015 and beyond, he or she must hold at least a Master's degree in an engineering discipline or its equivalent (MOE). In 2008, NCEES extended the implementation timeline to 2020. NCEES claims that it was motivated to add additional credits, due to the decline in university and college requirements for a bachelor's degree in engineering from an average of 144 credits 25 years ago to an average of 128 credits today.

The Bachelor's Plus 30 (B+30) Task Force paper and the ASME/ASHRAE position statement "Licensing that Works" have been posted to our website.

PLEASE NOTE: We will also be honoring Research Promotion Donors at this meeting. Certificates will be awarded and a special lunch will be served.

***Please RSVP at www.idahoashrae.com**

HISTORY LESSON

Five Years Ago

The chapter president was Xenon Long. The meeting was held on Friday, December 14, 2007, at the Idaho Power Building. This was a joint meeting with USGBC. Paul Kjellander, Idaho Office of Energy Resources, gave a presentation on "Idaho's Energy Future: A New Approach".

Ten Years Ago

The chapter president was Preston Nance. The meeting was held on Friday, December 13, 2002, at the Double Tree Riverside. Jack Lemley, Managing Director and Principal of Lemley & Associates, Inc., gave a presentation on the Eurotunnel, a rail transportation system from England to northern France, involving the construction of two terminals and three channel tunnels.

Twenty Years Ago

The chapter president was Richard Kartchner. The meeting was held on Friday, December 11, 1992, at Potomac Place. Don Parks, Professor at Boise State University, reviewed the history of engineering at Boise State University, and Bob Rinker, Director of Engineering at University of Idaho, talked about trends in engineering education in Boise.

Twenty Five Years Ago

The chapter president was Phil Terrell. The meeting was held on Friday, December 11, 1987, at the Kings Table Restaurant. McU Sports gave a presentation on outdoor winter fun.

NEWS FROM THE HOME OFFICE

Additional Combustion Safety Testing Options Proposed for ASHRAE Residential IAQ Standard

ATLANTA – Additional methods to demonstrate combustion safety – an area of major concern for homes in weatherization programs – are being proposed for ASHRAE's residential indoor air quality standard.

ANSI/ASHRAE Standard 62.2-2010, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings, defines the roles of and minimum requirements for mechanical and natural ventilation systems and the building envelope intended to provide acceptable indoor air quality in low-rise residential buildings.

Three proposed addenda to Standard 62.2-2010 currently are open for public review. For more information, visit www.ashrae.org/publicreviews.

Standard 62.2 currently has limits on exhaust that are based on specific assumptions about the house, specifically that the house is fairly tight. Proposed addendum w would provide professionals working in existing homes additional methods to demonstrate combustion safety, according to Paul Francisco, vice chair the Standard 62.2 committee. This addendum allows users to consider the attributes of the actual house when assessing combustion safety to determine whether there are conditions for sufficient depressurization to cause spillage of backdrafting of a combustion appliance. This is typically an issue for atmospherically-vented appliances, usually caused by some combination of excessive exhaust, duct leakage and door closures that cause pressure imbalances.

"Combustion safety is a major issue for weatherization programs that are using Standard 62.2," Francisco said. "The majority of homes in those programs are leakier than the assumed leakage in the current 62.2 exhaust flow limit, even

ASHRAE, founded in 1894, is an international organization of some 50,000 persons. ASHRAE fulfills its mission of advancing heating, ventilation, air conditioning and refrigeration to serve humanity and promote a sustainable world through research, standards

after retrofit. The current limit in 62.2 can prescriptively preclude them from using an exhaust option even though from a performance standpoint there would not be a problem."

A secondary impact is that addendum w makes it clear that existing combustion appliances do not need to be brought up to current code as a minimum requirement of 62.2, while reinforcing that any new installations must be to code.

"The issue of bringing appliances up to code is also an issue for weatherization programs," Francisco said. "There are many appliances installed that operate satisfactorily despite not being installed to the latest code. With the limited budgets of retrofit programs, as well as rules in some programs prohibiting spending these limited dollars bringing existing appliances up to code unless there is a demonstrated active concern, making it clear that it is a not a mandatory requirement of 62.2 makes it easier for these programs to fully adopt 62.2 while still delivering a final result that is safe for the residents."

One other addendum is open for public review from Sept. 14 until Oct. 14, 2012. The Standard 62.2 committee received comments from users of the standard, especially on addendum n, who did not understand which height was to be used when calculating the Normalized Leakage. Proposed addendum v would clarify the intent of the standard on how to calculate the building height.

Also open for public review from Sept. 14 until Oct. 29 is addendum u, which simplifies compliance with the intermittent ventilation requirements of Section 4.5 if the duty cycle is three hours or less. Under the current wording, designers of intermittent systems had to calculate a ventilation effectiveness factor even if operating the system 90 percent of the time with a duty cycle of one hour. This proposed addendum returns to the three hour maximum duty cycle from earlier editions of 62.2 before the ventilation effectiveness factor must be reduced below 1.0. This will simplify compliance for 80 percent of the users of 62.2. It also addresses the use of two or more fans to provide the required ventilation rate. For more information, visit www.ashrae.org/publicreviews.

Students Read Up on Their Practical Design Knowledge to Win ASHRAE Design Competition

ATLANTA—ASHRAE's 2012 Student Design Competition had participants staying up late and doing their research of HVAC&R system selection and design calculations as well as integrated building design to encourage practical design.

This year's competition featured a mock design of the newly constructed Joe and Rika Mansueto Library located in Chicago, Ill. The library consists of a glass dome covering 15,000 square feet of usable area on the ground floor, half of which is dedicated to a reading area and half to a preservation laboratory. The lower level of the building consists of a large warehouse for archived publications and materials.

Among the entries from around the world, three were awarded first place in the three categories that the competition offers.

First place in HVAC System Design Calculations is awarded to John Bisacquino, Josh Dennis and Travis Westover of Temple University, Philadelphia, Pa. Their faculty advisor is Steven Ridenour, Ph.D., P.E.

The team chose a ground source heat pump system to generate hot and chilled water for the entire building. In order to eliminate the necessity of a cooling tower, a ground source water loop rejects heat to the earth in the cooling mode and absorbs heat in the heating mode. Ground source heat pumps have a lower operating and maintenance coast and analysis showed any additional cost of installation would be covered in as little as 10 years.

For the interior rooms on the ground floor, packaged water to air heat pumps were specified, which can be incorporated in spaces with smaller heating and cooling load requirements. For the larger areas of the ground floor (grand reading room, etc.), air handling units with water to water heat pumps will be installed to meet the larger capacities required for heating and cooling. Water to water heat pumps generate hot and chilled water, while the air handling unit filters and supplies the conditioned air to the space.

In order to maintain strict temperature and humidity levels in the basement storage area, a constant air volume with system will be installed. Due to the high volume of books being stored in the basement, the air must circulate continuously to maintain the target temperature and humidity levels specified by the owner. Since strict humidity levels

are desired, a desiccant dehumidifying system was designed.

First place in HVAC System Selection is awarded to Alaina Booth, Adam Buck, Jami Harper, John May and Patrick MacBride of the University of Nebraska-Lincoln, Nebraska. Their faculty advisor is Joe Hazel, P.E., ASHRAE-Certified Healthcare Facility Design Professional.

After analyzing three system designs for the library, the team selected a ground coupled heat exchanger (GCHE) to serve a modular packaged heat recovery chiller system with variable air volume air handling units for the upper level of the library, and constant air volume air handling units for the periphery of the upper level and the lower level archive area.

The GCHE consists of a geothermal loopfield that transfers heat as needed for the primary system; the loops converge at the packaged heat recovery chiller to transfer energy to and from the field to the building systems. The air handling units for the upper level serve both terminal boxes in office areas, and a displacement ventilation system in the open areas of the library. The constant volume air handling unit serving the archive area includes a dual energy recovery unit to tightly control humidity. In order to better serve the high ceiling space, two air circulation units are placed at either end of the archive area so that stratification cannot occur.

The selected system shows a 73 percent improvement in energy efficiency compared to the ASHRAE Standard 90.1 baseline building model and is projected to reduce operating costs approximately $1.35 million over 20 years.

First place in Integrated Sustainable Building Design is awarded to Dustin Altschul, Prathamesh Chakradeo, Ravik Chandra, Saikrishna Ganesan, Timothy Hertel, Varun Krishnan and Charles Stratton of the University of Cincinnati, Cincinnati, Ohio. Their advisor is Raj M. Manglik, Ph.D.

To meet the electrical demand of the building, the students decided that photovoltaic glass would be used on the dome of the library. Daylighting also played a large role in the students' design, and window glazing was selected to offer a balance between solar heat gain and visible transmittance.

Due to the specific humidity requirements of the archives of the library, the team determined that two individual air distribution systems were necessary, which ultimately allowed for more control and energy operating costs savings. Geothermal heating was selected as the central heating system, which requires little maintenance and has a low operating cost.

Additionally, exterior insulated concrete walls, which allow for no air infiltration, minimize noise and the transference of heat and cold and a switch to dual flush toilets, along with rainwater harvesting, will reduce water consumption by 22 percent.

The competition recognizes outstanding student design projects, encourages undergraduate students to become involved in the profession, promotes teamwork and allows students to apply their knowledge of practical design.

The projects are shared at the 2013 Winter Conference in Dallas, Texas Jan. 26-30.

Groundbreaking Information for Data Center Energy Efficiency Guidance: ASHRAE Releases Third Edition of Thermal Guidelines for Data Processing Environments

ATLANTA – Four new data center classes that can enable fulltime economizers for a number of applications in many climates are contained in the latest edition of the principal book in the ASHRAE Datacom Series of publications.

Since its first edition in 2004, ASHRAE's "Thermal Guidelines for Data Processing Environments," published by ASHRAE's Technical Committee (TC) 9.9, Mission Critical Facilities, Technology Spaces and Electronic Equipment, has become the de-facto reference material for unbiased and vendor-neutral information on the design and operational parameters for the entire datacom (data centers and telecommunications) industry.

Based on the latest information from major IT equipment manufacturers, which are an integral part of the committee, it has never been easier to obtain the most meaningful data to guide data center designers and operations staff to design and run their facilities in the most energy efficient manner possible, including how to operate in a completely "chilllerless" environment. Further, the guidance enables a more energy efficient operation without compromising the reliability or "mission" of the data center.

"This third edition creates more opportunities to reduce energy and water consumption but it is important to provide this information in a manner that empowers the ultimate decision makers with regards to their overall strategy and approach," Don Beaty, chair of the Publications

Subcommittee of TC 9.9, said. "The idea is to provide objective data, methodology and guidance, but at the same time, respect the right of the data center designers, owners and operators to optimize the operating environment of their data center based on the criteria most important to their business needs."

Highlights in this third edition include new air and liquid equipment classes and expanded thermal envelopes for facilities that are willing to explore the tradeoffs associated with the additional energy saving of the cooling system through increased economizer usage and what that means in terms of the impact to IT equipment attributes such as reliability, internal energy, cost, performance, contamination, etc.

"The most valuable update to this edition is the inclusion of IT equipment failure rate estimates based on inlet air temperature," Beaty said. "These server failure rates are the result of the major IT original equipment manufacturers (OEM) evaluating field data, such as warranty returns, as well as component reliability data. This data will allow data center operators to weigh the potential reliability consequences of operating in various environmental conditions vs. the cost and energy consequences."

The book is part of the ASHRAE Datacom Series, developed to provide a more comprehensive treatment of datacom cooling and related subjects. Other books in the series are "Green Tips for Data Centers," "Particulate and Gaseous Contamination in Datacom Environments," "High Density Data Centers – Case Studies and Best Practices," "Design Considerations for Datacom Equipment Centers," "Best Practices for Datacom Facility Energy Efficiency," "Datacom Power Trends and Cooling Applications," "Real-Time Energy Consumption Measurements in Data Centers," "Liquid Cooling Guidelines for Datacom Equipment Centers" and "Structural and Vibration Guidelines for Datacom Equipment Centers."

The cost of "Thermal Guidelines for Data Processing Environments, Third Edition," is $54 ($46, ASHRAE members). To order, contact ASHRAE Customer Contact Center at 1-800-527-4723 (United States and Canada) or 404-636-8400 (worldwide), fax 404-321-5478, or visit www.ashrae.org/bookstore.

ASHRAE Brings Technology, People Power in Support of Engineering for Change

ATLANTA – ASHRAE has joined forces with an international engineering program to encourage its members to use their knowledge and technology to meet humanitarian challenges across the globe.

ASHRAE is now a network supporter of Engineering for Change (E4C. E4C is a growing community of engineers, technology professionals, designers, scientists, non-governmental organizations (NGOs) and local community advocates who are working together to design, apply and share innovative and sustainable technical solutions to a broad range of humanitarian challenges in local communities around the world.

"By partnering with Engineering for Change, our members can contribute their knowledge and our technology to help improve the quality of life for people around the world," ASHRAE President Tom Watson said. "Our involvement allows us to match the technology to the need, to find affordable solutions that benefit communities and ourselves."

"We are delighted to welcome ASHRAE to the E4C coalition," Noha El-Ghobashy, president of Engineering for Change, said. "ASHRAE's longstanding commitment to the promotion of engineering excellence in the service of sustainability and humanity makes it a natural ally for the work of the E4C coalition. We look forward to working together with ASHRAE and its distinguished membership for years to come."

The initiative is part of Watson's presidential theme Broadening ASHRAE's Horizons, which emphasizes the role of ASHRAE members as leaders in the application of sustainable design and practices in our communities worldwide.

Under E4C (www.ashrae.org/e4c), ASHRAE members can get involved with existing projects or start new ones. Watson noted that there is a wide range of projects – from refrigeration to hospitals to indoor air quality – to which members could contribute their technical expertise.

Watson also is encouraging ASHRAE members and chapters to examine ways to get more involved in their local communities. Another effort underway is ASHRAE's Community Sustainability Project program (www.ashrae.org/community), which is designed to encourage members to volunteer with local non-profits or other associations for activities such as engineering and installation of energy efficiency measures for their facilities.

Cold Climate HVAC Conference Advances Building Research and Design

ATLANTA – Papers providing an international perspective on the current state of design and practice of buildings in cold climates will be presented at the 7th International Cold Climate HVAC Conference, Nov. 12-14, 2012, in Calgary, Alberta, Canada.

ASHRAE is hosting and organizing the conference with support from the Federation of European Heating and Air Conditioning Associations(REHVA), a co-sponsor, and the Scandinavian Federation of Heating, Ventilation and Sanitary Engineering Associations (SCANVAC), the conference originator. This is the first time the conference is being held in North America.

The conference features keynote speakers, technical tours and social programs, and a technical program with some 55 papers organized on the following topics: Building Envelope, Ventilation Applications, Vacuum Insulation Panels and Phase Change Materials, Air Cleaning Technologies, Ventilation and IAQ, Codes and Standards, HVAC Systems and Equipment, Big Building Applications, Wind, Stack and Envelope Airtightness, and Alternate Energy Sources and Generation.

The papers cover a number of different applications, including office buildings, hospitals, laboratories, shopping malls, oil and gas facilities, supermarkets, schools and houses and present practices in Sweden, China, Canada, Russia, Greenland and South Korea, among other countries.

Similarly, the range of papers address moisture conditions in exterior walls; exterior insulation envelope retrofits in sub-arctic environments; field studies of displacement ventilation in Canadian schools; energy performance and IAQ in Greenland; run-around energy recovery systems in cold climate zones; case study of typical Canadian high arctic construction; energy derived from wastewater; new approach to mechanical insulation; integration of energy efficient technologies in arctic communities; high performance laboratory design for sub-arctic conditions; solar-assisted heat pump system; cogeneration with absorption heat pump for district heating; and a 600 Kw bio-mass power plant.

The conference concludes with a planning session seeking attendees' comments and insight on the development of a new ASHRAE Cold Climate Design Guide. To register or for more information, go to www.ashrae.org/ColdClimate.

IAQ 2013 Examines Environmental Health in Low Energy Buildings

ATLANTA—ASHRAE announces a call for abstracts for IAQ 2013, Environmental Health in Low-Energy Buildings. The conference will examine IAQ, thermal comfort, source control, air cleaning, ventilation, exposure and related environmental health concerns associated with low energy building design, construction, retrofit and operation.

The conference, IAQ 2013, Environmental Health in Low-Energy Buildings, takes place Oct. 15-18, 2013, in Vancouver, British Columbia, Canada. This conference is co-organized by ISIAQ and is the 17th in the ASHRAE IAQ conference series.

"Besides addressing thermal comfort and other IEQ issues, buildings and other enclosed spaces are increasingly challenged to provide a healthy environment while focused on minimizing energy use intensity," Steve Emmerich, conference co-chair, said.

"The complex relationship between indoor and outdoor environmental conditions, coupled with the impacts of climate change, requires a paradigm shift towards creating buildings that are not only comfortable but also healthy for the occupants while minimizing energy consumption and greenhouse gas emissions," Hal Levin, co-chair, added.

Levin noted that increasing energy consumption is only one way to achieve the goal of improved IAQ and thermal comfort. It can also be achieved without significant increase or even with decreased energy consumption. However, the current focus on energy efficiency often results in insufficient consideration of the environmental health impacts of reduced energy efficiency use in buildings.

IAQ 2013 will review the state of knowledge of the balance of environmental health and energy efficiency in buildings and help define future education, policy and research directions. The roles of building, HVAC and passive system design and operation for achieving good environmental health in low energy buildings (both new and retrofit) are the core themes of this conference.

The conference program will include internationally acclaimed keynote speakers, original peer reviewed conference papers and extended abstract presentations. Abstracts are invited in the following subject areas:
• Environmental Health in Low Energy Buildings • Moisture and Health • Sources and Chemistry • IEQ Factor Interactions • Residential Buildings • Commercial and

Institutional Buildings • Air Cleaning and Filtration • Microorganisms and Infection • Tools (models, measurements and more)

For more detailed descriptions of each of the topic areas, visit www.ashrae.org/iaq2013. The deadline for abstracts is Dec. 15, 2012. Abstracts, containing titles and 300 words or less summaries, should be submitted via the submission for at www.ashrae.org/IAQ2013. For more information e-mail IAQ2013@ashrae.org or visit www.ASHRAE.org/IAQ2013.

DOE Appoints ASHRAE Building Energy Codes Fellow

ATLANTA – The U.S. Department of Energy (DOE) has appointed its 2012-13 Building Energy Codes ASHRAE Fellow to assist in a variety of code development and deployment activities.

ASHRAE member Ian LaHiff will assist in the DOE's Office of Building Technologies, Building Energy Codes program in areas such as residential and commercial code research and development; developing code change proposals; code compliance and energy code training; developing and implementing tools and training programs aimed at increasing compliance; assessing the impact of adopting and updating state energy codes ; and performing analysis of energy savings and cost effectiveness of proposed code revisions and published codes.

"This fellowship will give me the opportunity to combine design experience with my knowledge of industry research," LaHiff said. "I hope to bridge the gap, helping the construction community adopt the latest, cutting-edge building techniques, codes and standards while pushing the industry forward and keeping the end user in mind."

LaHiff most recently worked with exp as a mechanical design engineer and project coordinator for healthcare and mission critical facilities. He has also performed research at the Florida Solar Energy Center funded by both DOE and ASHRAE. His research findings contributed toward the Building America Industrialized Housing Partnership that refined construction standards to maximize building energy efficiency. LaHiff's investigations into uncontrolled airflows and building leakage also helped highlight envelope construction best practices for residential and commercial facilities.

LaHiff graduated from the University of Central Florida with a Bachelor of Science in Mechanical Engineering with a focus on energy systems.

ASHRAE launched its Washington Fellow program in 2007 to allow participants to work in the federal government in a technical advisory role for limited terms. The Society is accepting applications for additional DOE ASHRAE Fellows. For more information on the program, contact Doug Read, ASHRAE director of Government Affairs, at dread@ashrae.org.

ASHRAE, AHR Expo Return to Dallas, Texas for 2013 Winter Conference

ATLANTA—Deep in the heart of Texas, where the stars at night are big and bright, ASHRAE is convening for its 2013 Winter Conference to corral energy use and blaze the way in high performing building design.

The 2013 Winter Conference takes place Jan. 26-30 at the Sheraton Dallas. To register and for complete Conference information, visit www.ashrae.org/dallas.

The International Air-Conditioning, Heating, Refrigerating Expo®, held in conjunction with the Winter Conference, will run Jan. 28-30. The Expo, www.ahrexpo.com, is held at the Dallas Convention Center.

In keeping with ASHRAE's goal of continuing education the Conference offers some 200 Professional Development Hours, as well as Continuing Education Units, which can be applied toward a professional engineering license.

The technical program features more than 200 sessions addressing energy conservation; facility management: operations, technology and energy improvements; large building design; standards, guidelines and codes; HVAC&R systems and equipment; HVAC&R fundamentals and applications; and refrigeration. One particular track of note is Industrial and Transportation Ventilation, focusing on the industrial and manufacturing sector prevalent in Texas. The full Technical Program offers the opportunity to earn a year's worth of PDHs, NY PDHs, AIA LUs and LEED AP credits and runs Jan. 27-30.

Five Professional Development Seminars and 15 Short Courses are offered to help industry professionals stay current on HVAC technology, including how to apply the newest ASHRAE standards. The ASHRAE Learning Institute (ALI) is offering five new half-day short courses on everything from the basics of laboratory design to techniques for optimizing HVAC systems and components. The full-day professional development seminars focus on the commissioning process; data center energy efficiency; healthcare facilities; complying with Standard 90.1-2010 and energy modeling best practices. ALI courses are

approved for renewal of professional engineer and professional architect licenses, as well as for industry certification programs. www.ashrae.org/Dallascourses.

The Conference's Plenary will feature former Pittsburgh Steelers quarterback Rocky Bleier. Despite being wounded in both legs during the Vietnam War, he embarked on a two-year road to recovery, and eventually pressed on to become one of the Steelers' top leading ground-gainers, passing the 1,000-yard rushing mark in one season, and contributing to four Super Bowl victories. Bleier's speech, "Be the Best You Can Be," motivates audiences to keep on striving for greater accomplishments. He shares his remarkable story during the Plenary, 3:15 p.m., Saturday, Jan. 26.

Additionally, ASHRAE offers a special administration of all six certification examinations on Wednesday Jan. 30: Building Energy Assessment Professional (BEAP), Building Energy Modeling Professional (BEMP), Commissioning Process Management Professional (CPMP), High-Performance Building Design Professional (HBDP), Healthcare Facility Design Professional (HFDP) and Operations & Performance Management Professional (OPMP). ASHRAE's certification program recognizes industry professionals who have mastered knowledge and skills reflecting best practices in certain aspects of building design and operations. More information on each certification can be found at www.ashrae.org/certification.

ASHRAE Conference technical tours give you a first-hand look at technology developed by members to further the industry. Tours include the Southern Methodist University, the Baylor Charles A. Sammons Cancer Center and Cowboys Stadium.

Additional Compliance Path Proposed for ASHRAE/IES Energy Standard

ATLANTA – A proposed optional third path for compliance with the ASHRAE/IES energy standard would provide more flexibility for the industry.

Addendum bm to ANSI/ASHRAE/IES (Illuminating Engineering Society) Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings, is currently open for public review from Oct. 12 until Nov. 26, 2012. For more information, visit www.ashrae.org/publicreviews.

The proposed addendum would add a compliance path to Standard 90.1 to allow modeling in accordance with Appendix G (Performance Rating Method), provided the percentage improvement of at least 45 percent over a baseline design. In addition, this addendum proposes to make the baseline consistent with the prescriptive requirements of 90.1-2004, and it will remain that way in future versions of the standard.

The current paths in the standard – the Energy Cost Budget method and the Performance Rating Method – can lead to different modeling protocols for different functions, according to Michael Rosenberg, a member of the Standard 90.1 committee. All require slightly different rules, and a single project could require two or more different baselines.

"By allowing an additional compliance option, the standard provides more credit for integrated design resulting in energy savings such as efficient use of building mass, optimized building orientation, efficient HVAC&R system selection and right sizing of HVAC&R equipment," Rosenberg said.

The baseline could stay the same for beyond code programs as well such as the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) rating program, ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings, and the federal tax incentive programs. Each simply chooses their own "% better than" target, according to Rosenberg.

"In addition, the performance path will no longer lag behind the prescriptive path as in the past it was not possible to incorporate prescriptive changes that occurred near publication date into the performance path ," he said. "It also allows for a deliberate and consistent trend for energy reduction in each version of the standard, instead of just following the prescriptive path.

Mandatory Commissioning for All Buildings Proposed for Green Building Standard

ATLANTA – Commissioning for all buildings designed and built under a green building standard from ASHRAE, the U.S. Green Building Council (USGBC) and the Illuminating Engineering Society (IES) would become mandatory under a new proposal open for public input.

ANSI/ASHRAE/USGBC/IES Standard 189.1-2011, Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings, provides a design standard for those who strive for high performance buildings. It covers key topical areas of site sustainability, water-use efficiency, energy ef¬ficiency, indoor environmental quality and the building's impact on the atmosphere, materials and resources.

Proposed addendum p would remove the "Acceptance Testing" provision (Section 10.3.1.1Building Acceptance Testing) for small buildings. The proposed addendum is open for public review from Oct. 19-Nov. 18, 2012. To comment on the proposed changes or for more information, visit www.ashrae.org/publicreviews.

Currently the standard implies that when a building area is less than 5,000 square feet it is considered to have simple building systems, and thus requires a reduced level of commissioning effort, referred to as Acceptance Testing, according to Jeff Ross-Bain, a member of the Standard 189.1 committee. However, building area does not relate to complexity as many buildings less than 5,000 square feet can be complex.

Under the proposed addendum, building commissioning per Section 10.3.1.2 becomes mandatory for all buildings that are designed and built under the requirements of the standard.

"Commissioning is a robust and well supported discipline with established guidelines (ASHRAE and others), a long history of use and with many practitioners," he said. "The commissioning process is one that adapts to the specific attributes of a given building. A 'simple' building would only require 'simple' commissioning regardless of size."

Ross-Bain noted that "Acceptance Testing" is not a universally defined activity nor does there appear to be specific instructions or guidelines within the industry detailing how this activity is formally completed. Also, a review of the mandatory requirements of Standard 189.1 could be interpreted as producing a relatively complex building (i.e. consumption measurement, on-site renewable energy, daylighting control, outdoor air delivery monitoring, economizers, condensate recovery, etc.), which requires a higher degree of commissioning activity.

Finally, under the current "Acceptance Testing" section, Standard 189.1 would not meet the minimum commissioning prerequisite of the Leadership in Energy and Environmental Design (LEED) rating system, which requires all buildings to undergo the commissioning process.

Developed by ASHRAE, ASPE, AWWA, USGBC: Water Conservation Standard Opens for First Public Comment

ATLANTA – With HVAC&R systems accounting for approximately a third of water consumption in a typical office building, the need to minimize water usage is a major consideration in the built environment industry.

A standard to provide baseline requirements for the design of buildings, site and mechanical systems is being developed by ASHRAE, the American Society of Plumbing Engineers (ASPE), the American Water Works Association (AWWA) and the U.S. Green Building Council (USGBC).

ASHRAE/USGBC/ASPE/AWWA Standard 191P, Standard for the Efficient Use of Water in Building, Site and Mechanical Systems, is currently open for public comment from Oct. 26 until Dec. 10, 2012. To comment on the proposed standard or for more information, visit www.ashrae.org/publicreviews.

"Water efficiency and conservation is a critical factor in the design and operation of buildings," John Swift, chair of the committee writing the standard, said. "Buildings consume 20 percent of the world's available water, a resource that becomes scarcer each year. Efficient practices and products provide opportunities to save significant amounts of water. The reduction of energy use and operating costs and the expectation of increased government regulation will continue to drive faster adoption of water-efficient products and methods."

The requirements in the standard would optimize the volume of water required to operate HVAC systems, plumbing systems and irrigation systems. There is currently no standard document that adequately and comprehensively addresses the issue of how to efficiently use water in the design, construction and operation of buildings, according to Swift.

The proposed standard covers HVAC&R and non-HVAC&R systems including: evaporative heat rejection, humidification systems, thermal storage, ground source pump systems, water heating systems, laboratory facilities and residential appliances. It would not apply to storm water management.

The standard will provide the tools that a design team needs to properly apply water efficiency measures on all aspects of a building design and construction project. In order to optimize water efficiency in buildings, plumbing, fire protection and HVAC&R engineers must work closely with civil engineers and landscape architects in putting together a functional building mechanical system.

ASHRAE to Hold "Breaking News" Standards Update at 2013 Winter Conference

ATLANTA – "Extra! Extra! Hear All About It!" Attendees at ASHRAE's 2013 Winter Conference will be the first to learn about the latest goings-on related to Society standards as part of the technical program.

The 2013 Winter Conference, www.ashrae.org/dallas, takes place Jan. 26-30 at the Sheraton Dallas. The International Air-Conditioning, Heating, Refrigerating Expo® (AHR Expo), www.ahrexpo.com, held in conjunction with the Winter Conference, runs Jan. 28-30 at the Dallas Convention Center.

The technical program features more than 200 sessions and offers the opportunity to earn a year's worth of PDHs, NY PDHs, AIA LUs and LEED AP credits and runs Jan. 27-30.

Among the sessions is a seminar, "Conference Breaking News on Standards 90.1, 62.1 and 189.1," 2:30 – 4 p.m. Monday, Jan. 28. Updates on the activities of the committees overseeing Standards 90.1 (ANSI/ASHRAE/IES Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings), 62.1 (ANSI/ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality) and 189.1 (ANSI/ASHRAE/USGBC/IES Standard 189.1-2011, Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings) will be shared by the committee chairs.

"The track deals with two well known and pervasive standards in our industry," Jon Cohen, who is chairing the track, said. "The third is a newer standard that has seen instant recognition and popularity, especially in light of our industry trend toward sustainability and net zero buildings. The fourth presentation goes hand in hand with the three standards. There are always advantages and disadvantages to achieving efficiency. Sometimes they must be weighed against each other. No matter what the decision, understanding consequences is important in design."

Wade Conlan, a member of ASHRAE's Conference and Exposition Committee who serves as technical chair for the Conference, said the goal in scheduling the program was two-fold.

"We wanted to provide a 'breaking news' program for the attendees as the presenters are talking about the latest and greatest changes/updates to the standards in a single program," he said. "We also wanted to provide something that attendees can take back to their employers that will be as current as if you were on the committees."

Presentations and speakers are:

- Advantages and Disadvantage of Alternative Formats to Achieve More Efficient Energy Codes for Commercial Buildings (DA-13-C017), Michael Rosenberg, Pacific Northwest National Laboratory, Richland, Wash.
- Standard 90.1, Stephen Skalko, P.E., Portland Cement Association, Macon, Ga.
- Standard 189.1, Dennis Stanke, Trane, La Crosse, Wis.
- Standard 62.1, Roger Hedrick, Architectural Energy Corp., Boulder, Colo.

The session is part of an overall track dedicated to standards, guidelines and codes.

"The track highlights an extremely important aspect of ASHRAE, the development of standards," Cohen said. "The track is not exclusive to ASHRAE standards, as other industry standards are important to our membership, but ASHRAE standards are an important and highly publicized portion of the Society."

Other sessions in the track are:

Forum: "Energy Monitoring of Systems and Equipment in ASHRAE Standards 90.1 and 189.1: How Far Should Building Codes Go?" 9:45-10:45 a.m., Jan. 28. Standard 189.1-2011 includes mandatory requirements for measurement devices with remote communication capability for energy sources above specified thresholds. Starting in 2013, Standard 90.1 will also require submetering of specific equipment or systems, but its provisions are based on different criteria and thresholds. This forum seeks input on issues related to energy consumption management in ASHRAE standards.

Seminar: "How Federal and State Energy Policy Impact ASHRAE Members," 2:30-4:30 p.m., Jan. 28, examines how federal and state government energy policy impacts ASHRAE and its members' work on a day-to-day basis and the ways in which members may participate more fully in the crafting of laws and regulations guiding the HVAC&R field.

Presentations and speakers are:

- Federal Energy Efficiency Policy, Kathleen Hogan, Ph.D., Office of Energy Efficiency & Renewable Energy, U.S. Department of Energy, Washington, D.C.
- State and Local Energy Efficiency Policy, Kateri Callahan, Alliance to Save Energy, Washington, D.C.
- History, Current Status, and Possible Future of Standard 90.1, Stephen V. Skalko, P.E., Portland Cement Association, Macon, Ga.

Forum: "Specifying BAS Networks and Integration: Ensure that Guideline 13 Provides the Guidance You Need!," 9:45-10:45 a.m., Tuesday, Jan. 29. Guideline 13,

Specifying Direct Digital Control Systems, provides recommendations for specifying building automation systems, as well as recommendations for specifying integration of other building systems into a building automation system. Since this Guideline was originally published, the landscape of networks and integration has changed significantly as existing technologies and architectures have matured and additional system architectures have emerged. The committee updating Guideline 13 is seeking to provide better and more current guidance for specifying BAS network infrastructure and integration.

Seminar: "Energy Benchmarks: Setting Standards or Feeding Fantasies?" 11 a.m.-12:30 p.m., Jan. 29. This seminar presents aspects of energy benchmarks that reflect their evolution, their perception, their fiscal value and their application in the fairly mature, and increasingly congested, European market.
Presentations and speakers are:

- Energy Benchmarks: Mirage or Reality? Hywel Davies, Ph.D., Chartered Institution of Building Services Engineers, London, England
- Financial Advantages of Benchmarked Buildings and MEP Systems, David Arnold, Ph.D., London South Bank University, London, United Kingdom
- Benchmarking: Gaming or Winning?, David Fisk, Ph.D., Imperial College London, London, United Kingdom

Seminar: "Building Labeling in Europe: European Standardization to Meet the Energy Performance Directive," 1:30-3 p.m., Jan. 29. In the United States, Leadership in Energy and Environmental Design (LEED), ENERGY STAR and ASHRAE's Building Energy Quotient (bEQ) are being used to label building energy performance. In the European Union, countries follow the Energy Performance of Buildings Directive (EPBD). The session reviews the European initiatives to evaluate building energy performance and to couple energy use with environmental quality.
Presentations and speakers are:

- EU Mandate to Develop the Second Generation Energy Performance Standards, Jaap Hogeling, ISSO, Lienden, Netherlands
- Nearly Zero Energy Buildings Definitions and System Boundaries: The REHVA View, Jarek Kurnitski, Dr.Ing., Finnish Innovation Fund Sitra, Helsinki, Finland
- Revision of EN15251: Indoor Environmental Criteria Bjarne W. Olesen, International Center for Indoor Environment and Energy, Technical University of Denmark, Lyngby, Denmark

Seminar: "Modeling SEER Rated Equipment," 9:45-10:45 a.m., Jan. 30. The Performance Rating Method of Standard requires the modeling of seasonal energy efficiency ratio (SEER) rated equipment in various baseline systems types. This can create issues if your modeling software does not accept SEER as an explicit input. What is SEER and how is it defined? Is there a conversion between SEER and energy efficiency ratio (EER)? The presentation and speaker is Modeling Part-Load Performance for SEER Rated Equipment, Duncan Synan McClellan, P.E., Clark Nexsen, Norfolk, VA

Seminar: "ASHRAE Position on Limiting Indoor Mold and Dampness in Buildings, Unvented Combustion Devices and Indoor Air Quality: Review of Three Recently Published ASHRAE Position Documents," 11 a.m.-12:30 p.m., Wednesday, Jan. 30. The seminar reviews three recently published Position Documents from ASHRAE on indoor mold and dampness in buildings, unvented combustion devices and indoor air quality.
Presentations and speakers are:

- The Revised ASHRAE Position Document on Limiting Indoor Mold and Dampness in Buildings, Lew Harriman, Mason Grant, Portsmouth, N.H.
- ASHRAE Position Document on Unvented Combustion Devices, Paul W. Francisco, University of Illinois, Champaign, Ill.
- ASHRAE Position Document On Indoor Air Quality, Chandra Sekhar, National University of Singapore

ASHRAE Technology Awards Highlight Outstanding Building Projects

ATLANTA – Engineers play a vital role in their communities, working to provide safe, comfortable and energy efficient buildings for everyone from students to firefighters. The winners of the 2013 ASHRAE Technology Awards have proven the value of engineering in their communities with the design of a fire station, hospital, university recreation center, nature museum, offices and even a national energy laboratory.

The ASHRAE Technology Awards recognize outstanding achievements by members who have successfully applied innovative building design. Their designs incorporate ASHRAE standards for effective energy management and indoor air quality. The awards communicate innovative systems design to other ASHRAE members and highlight technological achievements of ASHRAE to others around the world. Winning projects are selected from entries earning regional awards.

Following are summaries of the winning projects.

Research Support Facility, National Renewable Energy Laboratory (NREL)
C-K Joseph Tai, P.E., Stantec Consulting, Inc., San Francisco, Calif., receives first place in the new commercial buildings category for the Research Support Facility,

NREL, Golden, Colo. The building is owned by the National Renewable Energy Laboratory. Tai and his team also receive the Award of Engineering Excellence for the project.

The Research Support Facility (RSF) is a new 219,105 ft² office building on NREL's campus in Golden, Colo. It includes everything from open and private offices to a fitness center and library. The criteria for designing the building included an absolute energy use intensity (EUI) goal of 35kBtu/sf/year, net-zero energy and the ability to use the building as a living lab to demonstration energy efficiencies strategies.

The key to the RSF's success are its integrated systems. Lighting in the building is an integrated system of architectural and interior design details, daylight control systems, occupancy controls and high efficiency lighting. Ninety-two percent of all typical work spaces are designed to receive adequate daylight using a narrow floor plate and advanced light bouncing device. Thermal comfort is addressed using an integrated system of thermal mass, radiant slabs, night purging and natural ventilation. The total annual energy consumption of the building is 36 percent better than a baseline ASHRAE 90.1-2004 building; the measured EUI is 33kBtu/sf/year, while on-site photovoltaic system is sized at 35kBtu/sf/year.

The RSF offsets the vast majority of its energy footprint by using electrical energy produced by solar panels. The new data center is one of the most efficient in the world due to free cooling and IT efficiency measurements. It consumes 81 percent less energy than its predecessor, and thus reduces carbon emission by nearly five million pounds per year. In fact, the building is carbon neutral.

Rice Fergus Miller Office and Studio
Shawn Oram, Ecotope, Inc. Seattle, Wash. receives first place in the existing commercial buildings category for Rice Fergus Miller Office and Studio, Bremerton, Wash. The building is owned by Fifth Street Hilltop Partners, LLC.

The Rice Fergus Miller (RFM) Office and Studio is helping to revitalize historic downtown Bremerton, Wash., by turning an abandoned warehouse into a state of the art office building. After one year, the project has an EUI of 21.8 kBtu/sf/year, 76 percent better than the national average for office buildings, which is 93 kBtu/sf/yr. Notably, the building performance is coming within 10 percent of the modeled performance without calibration.

The RFM Office and Studio relies on occupants to play an active role in the operation and tuning of the building using an innovative "passive/active" hybrid mechanical system. The HVAC systems are designed to turn off when the outdoor temperatures are within the "passive mode" range. Red and green lights are used to signal the building mode to the occupants; green indicates passive mode when operable windows can be used for ventilation and cooling.

A high efficiency variable refrigerant volume/flow heat pump (VRV/F) system provides space heating and cooling for 23 independent zones. The VRV/F system is switched from heating to cooling on either side of the passive operation mode; however, the super-insulated naturally ventilated building allows the heat pumps to be off for 70 percent of the year. Ventilation is provided by two energy recovery ventilators (ERV) controlled in stages based on CO2 levels. A large de-stratification fan is positioned over a central opening between the upper and lower floors. The fan mixes the space, acting as a replacement for a traditional ducted distribution system and at higher speeds provides cooling. Waste heat from the server room is recovered and used to heat the building.

The project makes use of the plentiful rainfall for irrigation and toilet flushing from a 6,000 gallon rainwater storage, filtration and pumping system in the garage. The design offsets over 60,000 gallons of potable water use annually.

Portland State University Academic and Student Recreation Center (PSU ASRC)
Mark Koller, P.E., Interface Engineering, Portland, Ore, receives first place in the new educational facilities category for the design of the Portland State University Academic and Student Recreation Center, Ore. The building is owned by the University.

This new building on PSU's downtown campus is home to the School of Social Work, the Oregon University System Chancellor's Office, the recreation center—including a gymnasium and natatorium—bike hub and the City of Portland Archives.

The natatorium is served by a dedicated indoor dehumidification unit, which has air-to-air plate heat recovery, variable speed fans with dew-point control and heat recovery. The building's gym, which consists of three courts and an elevated running track, is served by a dedicated air handler with a well water cooling coil, heating coil, variable speed fan and economizer with stack relief. The exercise equipment contains small generators which feed electricity to the building. This is used to teach building occupants how much effort is involved in generating a single kilowatt.

Radiant loss through the high percentage glazing in the lobby of the building is offset by the use of hydronic floor

heating, as well as hydronic perimeter convectors. Fan-powered terminal units were utilized in most exterior zones in order to help offset envelope losses. Also, the street level retail spaces are served by a water source heat pump system that uses water from the on-site well. In the cooling season the building rejects heat to this water which is then pumped back to the ground via an injection well. In the heating season those spaces that need heat will be able to extract heat from this 56 F water.

Eastside Fire and Rescue Station 72
Jonathan Heller, P.E., Ecotope, Inc., Seattle, Wash., receives first place in the new other institutional facilities category for the design of the Eastside Fire and Rescue Station 72, Issaquah, Wash. The building is owned by the City of Issaquah.

The new fire station includes offices, living quarters, three truck bays and support spaces. The building uses 70 percent less energy and 50 percent less water compared to other typical fire stations in the region. The building was able to achieve these reductions through the use of super-insulation, heat recovery ventilation, radiant heat distribution, ground source heat pumps, solar water preheat, high efficiency appliances, advanced lighting designs and controls, and real-time energy use feedback to the occupants.

The station is held at relatively constant temperature with radiant heating and cooling in the slab. However, due to the stressful and physically demanding work required of the firefighters, the sleeping rooms are equipped with 4-pipe fan coils with individual temperature control in each private room. This allows firefighters access to cooling on demand when needed to relax after an emergency call. Also, since firefighters often have to leave the station quickly, there is not time to turn off equipment and lights. Therefore, every room has occupancy sensors for shutting off lights and unnecessary equipment. The plug receptacles that are switched from the occupancy sensors are color coded so that all non-critical equipment can be turned off with occupancy.

One innovative aspect of the fire station is the interconnection between the solar thermal and ground source heat pump systems. A large solar thermal array was included due to the high level of hot water use in the fire station. If the solar preheat water tanks are satisfied, the excess heat collected by the solar thermal system is discharged to the geothermal loop field to recharge the ground temperature.

Swedish Issaquah Hospital
Jeremy McClanathan, ASHRAE-Certified Building Energy Modeling and Healthcare Facility Design Professional, CDi Engineers, Lynnwood, Wash., receives first place in the new health care facilities category for the Swedish Issaquah Hospital, Issaquah, Wash. The owner is Swedish Health System.

The new hospital includes an emergency department, operating rooms, imaging, cardiology and in-patient rooms. Through innovative design, the building was able to achieve a 54 percent energy savings compared to a baseline EUI 250 kBtu/sf/year for a typical hospital. Efficiency measures include a central plant heat recovery system (HRS); the use of variable air volume (VAV) air systems; recirculating air handling units (AHU) with select units 100 percent outside air capable for pandemic mode; low velocity ductwork, high efficiency AHUs and chillers; and efficient envelope and lighting.

The most innovative efficiency measure employed in the project was the central plant HRS that is estimated to provide approximately 80 percent of the building's heating and domestic hot water with energy recovered from internal loads. It utilizes a centralized heat pump, advanced controls, heat recovery coils and a series of heat exchangers to move heat from the chilled water system to the hot water systems. In order to maintain the required pressure relationships mandated in hospitals for infection control, the building utilizes return and exhaust air tracking terminal units and venture valves in its ventilation system. This allows central AHUs to vary supply airflow rates based on demand.

Carbon emissions for the building are 47 percent lower than a baseline building, reducing 6,513 tons of carbon emissions each year. Additionally, the plumbing fixtures, selected to provide both water and energy savings, save 30 percent and 50 percent of the water used by standard fixtures.

Montréal Biodôme
André-Benoit Allard, Eng., Ecosystem, Québec City, Québec, Canada, receives first place in the existing public assembly category for the Montréal Biodôme, Quebec, Canada. The building is owned by Montréal Space for Life.

The Montréal Biodôme, a Space for Life, is filled with flora and fauna from five different replicated ecosystems from the Americas that are under one roof but vary greatly in terms of temperature, humidity and light requirements. An energy saving retrofit was performed on the building from 2008 to 2010. Overall, the building has experienced 55 percent energy savings since the retrofit and an 80 percent reduction in greenhouse gas emissions.

Central to the retrofit is an energy recovery and energy transfer system between the various ecosystems that is used to cool and heat other parts of the building The heat

recovery system includes four heat pumps with a total rated capacity of 1,450 tons. This design allows completely secure operation, even if one of the heat pumps suffers a technical problem. The chillers—or heat pumps—of the new power plant run on R-134a. The plant has three 450-ton heat pumps used for cooling and a fourth 250-ton heat pump is dedicated to the sub-polar region of the building where colder water/glycol solution is needed. This configuration allows the three heat pumps to work in a better efficiency range.

Additionally, 42 fan and pump motors have been replaced by high efficiency motors. A number of motors were resized depending on the load they carried. They are powered by variable frequency drives and fan speed is adjusted according to each ecosystem's unique schedule and temperature setpoint. The fresh air supply in certain sectors, such as the tropical rainforest, is controlled by CO2 sensors.

The Biodôme employs one of the biggest open-loop ground-source heat pump systems in Canada, with water drawn from the underground water some 30 meters below the building at a rate of 720,000 gallons/day. Depending on the time of year, the system meets heating and cooling needs that the heat recovery system cannot meet alone. During the summer, it is thus possible to transfer the heat from the heat pumps to the underground water and store the heat for the heating season.

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Healthcare Facilities: Best Practice Design & Applications
Saturday, Jan 26– 8:00 a.m. to 3:00 p.m.

Complying with Standard 90.1-2010
Tuesday, Jan 29 – 9:00 a.m. to 4:00 p.m.

Energy Modeling Best Practices and Applications: HVAC/Thermal
Tuesday, Jan 29 – 9:00 a.m. to 4:00 p.m.

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Air-to-Air Energy Recovery Fundamentals
Sunday, Jan 27 – 2:00 p.m. to 5:00 p.m.

Humidity Control: Applications, Control Levels and Mold Avoidance
Sunday, Jan 27 – 2:00 p.m. to 5:00 p.m.

Air-to-Air Energy Recovery Applications: Best Practices
Monday, Jan 28 – 8:30 a.m. to 11:30 a.m.

Application of Standard 62.1-2010: Multiple Spaces Equations & Spreadsheet
Monday, Jan 28 – 8:30 a.m. to 11:30 a.m.

Combined Heat & Power: Design through Operations
Monday, Jan 28 – 8:30 a.m. to 11:30 a.m.

Understanding Standard 189.1-2011 for High-Performance Green Buildings
Monday, Jan 28 – 2:45 p.m. to 5:45 p.m.

Introduction to Ultraviolet Germicidal Irradiation (UVGI) Systems
Monday, Jan 28 – 2:45 p.m. to 5:45 p.m.

Commissioning Process & Guideline 0
Monday, Jan 28 – 2:45 p.m. to 5:45 p.m.

Evaluating the Performance of LEED®-Certified Buildings
Monday, Jan 28 – 2:45 p.m. to 5:45 p.m.

Optimization of HVAC Systems & Components: Techniques & Real-World Examples
Tuesday, Jan 29 – 9:00 a.m. to 12:00 p.m.

Energy Management in New and Existing Buildings
Tuesday, Jan 29 – 9:00 a.m. to 12:00 p.m.

Avoiding IAQ Problems
Tuesday, Jan 29 – 9:00 a.m. to 12:00 p.m.

Designing Toward Net Zero Energy Commercial Buildings
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Understanding & Designing Dedicated Outdoor Air Systems
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