2009 ASHRAE Winter Conference Program

The Palmer House Hilton hosts the program Sunday, Jan. 25 – Tuesday, Jan. 27. McCormick Place, site of the ASHRAE co-sponsored AHR Expo, hosts Wednesday’s program.

Speakers and sessions subject to change. Date posted: Jan. 21, 2009.

Sessions marked with ⤵️ are proposed for New York PDH credits.

SUNDAY

- Kick off the conference with Adrian Bejan’s technical plenary speech on “constructal theory.”
- Three data center sessions address ASHRAE standards, energy efficiency and high density
- Building energy labeling — learn what is happening in the U.S., worldwide
- Here comes Standard 189.1P – high performance green building framework defined
- Chill with Plato in the “History of Cold” session

Sunday Sessions held at the Palmer House Hilton

Sunday, 1/25,
8 a.m.–9:30 a.m.

Transactions Session 1 (Advanced)

Innovative Building Ventilation Towards Sustainable Building Design

Track: Sustainability
Salons 8/9 (3)
Sponsor: 4.3 Ventilation Requirements and Infiltration
Chair: Fariborz Haghighat, Member, Concordia University, Montreal, ON, Canada

Current research demonstrates that the operation of non-industrial buildings contributes substantially to global energy consumption and raises many energy-related environmental issues. They also reveal that plenty of room remains for improvement and call upon a broader effort to promote energy effective measures during the design and operation stage of buildings. Ventilation systems are, in the very nature of their design, a means to bring in outdoor air, and to trap and dilute the contaminants. This session covers the technical and regulation information needed to be considered during the design and operation of buildings employ natural/hybrid ventilation system.
Transactions Session 2 (Basic)

Laboratory Testing of Duct Fittings to Determine Loss Coefficients

Track: Fundamentals

Water Tower Parlor (6)

Sponsor: 5.2 Duct Design

Chair: Stephen Idem, Ph.D., Member, Tennessee Tech University, Cookeville, TN

In ASHRAE RP-1319, an experimental program was initiated to determine the friction factor in circular corrugated galvanized spiral ducts. This session presents the results of the project, which performed an analysis to calculate the required diameter of corrugated ducts required to convey the same volumetric flow rate of air at the same pressure loss per unit length as non-corrugated spiral ducts. Likewise pressure loss coefficients were determined for the following types of flat oval elbows having various aspect ratios: 5-gore 90° easy bend, mitered 90° easy bend with and without vanes, and mitered 90° hard bend with and without vanes.

1. Pressure Loss of Corrugated Spiral Duct (CH-09-005)
   Devendra Kulkarni, Student Member; Swapnil Khaire, Student Member; Stephen Idem, Member, Tennessee Tech University, Cookeville, TN

2. Measurements of Flat Oval Loss Coefficients (RP-1319) (CH-09-006)
   Devendra Kulkarni, Student Member; Swapnil Khaire, Student Member; Stephen Idem, Ph.D., Member, Tennessee Tech University, Cookeville, TN

3. Influence of Aspect Ratio and Hydraulic Diameter on Flat Oval Elbow Loss Coefficients (RP-1319) (CH-09-007)
   Devendra Kulkarni, Student Member; Swapnil Khaire, Student Member; Stephen Idem, Ph.D., Member, Tennessee Tech University, Cookeville, TN

Seminar 1 (Intermediate)

Advances in Air to Refrigerant Heat Exchangers

Track: Systems and Equipment

Empire (L)

Sponsor: 8.4 Air-to-Refrigerant Heat Transfer Equipment

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

Factors that affect the performance of heat exchangers used for heating, cooling, and refrigeration are explored. These include advances in air to refrigerant modeling, longitudinal heat conduction in finned-tube evaporators and airside fouling.

1. Longitudinal Heat Conduction in Finned-Tube Evaporators
   Piotr A. Domanski, Ph.D., Fellow ASHRAE, National Institute of Standards and Technology, Gaithersburg, MD

2. Understanding the Impact of Airside Fouling on Outdoor Condensing Coils
   Mark Johnson, Associate Member, Modine Manufacturing, Racine, WI

3. Approximation Assisted Air-to-Refrigerant Heat Exchanger Optimization
   Omar Abdelaziz, Student Member, University of Maryland, College Park, MD

Seminar 2 (Intermediate)

Commercial Building Re-Tuning:
A Low-Cost Approach to Improved Performance and Energy Efficiency

Track: Operational Topics

Wabash (3)

Sponsor: 7.3 Operation and Maintenance Management, 7.6 Systems Energy Utilization

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

Large commercial buildings use sophisticated building automation systems (BASs) to manage a wide and varied range of building equipment. However, many buildings still do not fully use BASs capabilities and are not properly commissioned, operated or maintained. Tuning BASs and the systems they serve ensures maximum building energy efficiency, the comfort of building occupants, and more sustainable operation. A poorly tuned system can sometimes maintain comfortable conditions but at a higher energy cost to overcome inefficiencies. Re-tuning eliminates these problems primarily through adjustments to controls and...
implementation of other low-cost measures. Speakers provide an overview of the re-tuning process, identify targets that commonly yield significant improvements in operation and decreases in energy use, and discuss how re-commissioning can yield a "gold mine" in savings.

1. Mining Gold in Existing Facilities
   William McCartney, Member, Isotherm Engineering Ltd., Mississauga, ON, Canada

2. An Overview of Commercial Building Re-Tuning
   Michael R. Brambley, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA

3. Key Building Operation Faults and Their Correction
   Srinivas Katipamula, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA

**Seminar 3 (Intermediate)**

**Measuring Oil Concentration in Circulation**

**Track: Refrigeration**

**Track: Fundamentals**

Monday, 1/25, 8 a.m. – 9:30 a.m.

**Measuring Oil Concentration in Circulation**

**Track: Refrigeration**

Monday, 1/25, 8 a.m. – 9:30 a.m.

**An Introduction to Mesoscale Weather Models and their Application to ASHRAE Building Issues**

**Track: Fundamentals**

Monday, 1/25, 8 a.m. – 9:30 a.m.

**Will Wireless Controls Save Me Money?**

**Track: High Performance Systems**

Monday, 1/25, 8 a.m. – 9:30 a.m.
Technical Plenary Session

Track: Business Management

Monday (6)
Sponsor: Conferences and Expositions Committee

Why are lungs and river basins tree-shaped? Why are larger animals faster, stronger and less active? Why is there “technology evolution?” It can all be explained by “constructal theory.” And the man who developed the theory—which he says can predict how everything flows through time and space—presents his comments at the technical plenary session. Adrian Bejan, Ph.D., is the J. A. Jones Distinguished Professor of Mechanical Engineering at Duke University. He proposed the theory in 1996 and has since worked to predict with it a wide variety of phenomena, from geophysics to biology and social design. “The main principle of the constructal theory is that in order to persist in time (to survive) a flow system must change such that it flows easier and easier,” he said. “Every flow system has this natural tendency, and is destined to remain imperfect. The theory shows that the emergence of scaling laws in geophysical flow systems is the same phenomenon as the emergency of allometric laws in biological flow systems and that features of evolutionary design in nature can be predicted based on the constructal law.”

A meeting badge is required to attend this session.

High Density Cooling Updates

Track: Applications

Sunday (3)
Sponsor: 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment
Chair: Jeffrey P. Rutt, Member, U.S. Department of Defense, Bel Air, MD

Cooling of high-density electronic equipment installations such as data centers and telecommunication facilities are addressed. Data center power densities of 400 watts per square foot or higher are increasingly commonplace. In addition, energy costs are on the rise, making total cost of ownership and important consideration during the design of a new data center. The papers in this session will aid the engineer with some methods to reduce energy usage in a data center.

1. Particulate and Gaseous Contamination: Effect on Computer Reliability and Monitoring (CH-09-008)
Prabjit Singh, Ph.D., P.E.; Joseph F. Prisco, P.E.; Roger R. Schmidt, Ph.D., P.E., Member, IBM, Poughkeepsie, NY

2. Air Management Metrics in Data Centers (CH-09-009)
Robert Tozer, Ph.D., Member; Christopher Kurkjian, P.E., Member; Munther Salim, Ph.D., EYP Mission Critical Facilities, London, United Kingdom

3. Analysis of Ambient Conditions Suitable for Air-Side Economizer Operation with High Supply Air Temperatures in Datacom Environments (CH-09-010)
Thomas A. Davidson, P.E., Member, DLB Associates Consulting, Ocean, NJ

Sunday, 1/25, 11 a.m.–12:30 p.m.

Seminar 6 (Intermediate)

Automated Metering Infrastructure: What It Does and How It Can Help You

Track: Operational Topics

Sunday (6)
Sponsor: 7.5 Smart Building Systems
Chair: David F. Shipley, P.E., Member, Marbek, Ottawa, ON, Canada

Automated Metering Infrastructure (AMI) is creating a fundamental transformation of the electric grid using advanced communications and information technology infrastructure to support the deployment of a broad range of applications. Universal interval metering will create a rich store of energy use data that can be leveraged by utilities and customers to create insight and drive efficiency. Price or activity based demand side management will be enhanced by
infrastructure allowing price and control signals to the customer premise to support energy management automation or trigger advanced demand-side management, providing the HVAC&R industry new tools to increase efficiency, cost effectiveness, and sustainability.

1. Automated Metering Infrastructure: What It Does and How It Can Help You
Steven L. Blanc, P.E., Member, Pacific Gas and Electric Co., San Francisco, CA

2. Advanced Metering: How Can You Benefit from New Utility Tariffs and Programs?
Carlos Haid, P.E., Associate Member, Design & Engineering Services, Southern California Edison, Irwindale, CA

3. The AMI Data Firehose: How Can the Utility Keep Up With Validation and Estimation?
Robert C. Sonderegger, Ph.D., Member, Itron Inc., Oakland, CA

Sunday, 1/25, 11 a.m.–12:30 p.m.

Seminar 7 (Intermediate)

Best Maintenance Practices for Emission Reductions
Track: Operational Topics
Empire (L)
Sponsor: 3.8 Refrigerant Containment
Chair: Mark A. Adams, Member, Johnson Controls, York, PA

Refrigerant emissions from equipment leaks and end of life releases are receiving increased scrutiny from regulatory and environmental groups. New regulations are underway in North America and other parts of the world. This session presents some best practices of equipment maintenance to reduce emissions. This seminar includes information on supermarkets, HVAC equipment and best practices on leak detection.

1. Maintenance of Supermarket Systems
Danny Halel, Member, Hussmann Corp., Bridgeton, MO

2. Maintenance of HVAC Equipment
Juan M. Ontiveros, University of Texas at Austin, Austin, TX

3. Leak Detection Practices: Study Results
Denis Clodic, Member, Armines Cep, Paris, France

Sunday, 1/25, 11 a.m.–12:30 p.m.

Seminar 8 (Basic)

Building Energy Labeling and Certification Initiatives
Track: Sustainability
Monroe (6)
Sponsor: 7.6 Systems Energy Utilization
Chair: Mark E. Case, Member, ETC Group, LLC, Salt Lake City, UT

Building energy labeling and certification is becoming widely recognized as an important part of building energy performance improvement policy toolkits. Initiatives have evolved more rapidly in Europe in recent years with the implementation of the Energy Performance of Buildings Directive, and most European Member States have developed building energy labels and certification programs in response to that Directive. Other major economies, including China, where more building construction takes place than any other country, also have energy labeling programs underway. California and Washington, DC are requiring mandatory building benchmarking and a form of labeling, and several other states and/or cities in North America are also considering such requirements. ASHRAE is developing a program that will be rolled out over the coming year.

1. Overview of Global Building Energy Certification and Labeling Initiatives
Adam W. Hinge, P.E., Member, Sustainable Energy Partnerships, Tarrytown, NY

2. ASHRAE’s Building Energy Labeling Program
Ronald E. Jarnagin, Member, Pacific Northwest National Laboratory, Richland, WA

3. A View from Europe: Energy Labeling across the Atlantic
Hywel Davies, Chartered Institution of Building Services Engineers, London, England

Sunday, 1/25, 11 a.m.–12:30 p.m.

Seminar 9 (Intermediate)

Compressor Modulation Techniques
Track: High Performance Systems
Crystal (3)
Sponsor: 8.1 Positive Displacement Compressors
Chair: Curt R. Slayton, P.E., Member, Consulting Services International LLC, Louisville, KY

The ability to modulate compressor performance greatly enhances system energy efficiency by matching compressor performance to system load. Compressors can be modulated either electrically or mechanically. Electrical modulation is quite common, particularly in the Far East with BLDC and inverter driven motors. Mechanical modulation has more recently become an avenue for improving system efficiency.
District energy (i.e., central heating and cooling plants serving more than one building) has been a viable method of providing economical heating and cooling for large, densely populated users such as cities, towns, college campuses, airports, and industrial complexes. Due to their size, district plants typically offer better sustainable design opportunities for using thermal storage, cogeneration and alternative energy sources than do individual building heating and cooling systems. For these reasons, district energy can reduce the carbon footprint of the areas that they serve. This seminar focuses primarily on district cooling.

1. District Energy Overview
   John Andreopont, Member, The Cool Solutions Company, Lisle, IL

2. District Cooling in Downtown Indianapolis
   David Kiesel, P.E., Citizen’s Thermal Energy, Indianapolis, IN, Tim Anderson, P.E., Member, Applied Engineering Services, Indianapolis, IN

3. District Cooling at Abbott
   Joseph Wegryn, Member, Abbott, Abbott Park, IL

Smart Sensors and the HVAC Industry

Because of improved performance and decreased cost as well as the NIST-supported IEEE 1451 set of standards, smart transducers (sensors and actuators) will play an important role in future building automation system and smart building systems. This seminar introduces the standards to the HVAC community and provides an overview of current status of the smart sensors for common HVAC applications. The transducer electronic data sheet (TEDS) format that enables plug and play operation of traditional analog sensors and transducers is discussed and some practical aspects and approaches of implementing and integrating the smart sensor technology into contemporary measurement and control systems are presented. Also, a method for automatically detecting and correcting for sensor faults in HVAC control systems is described.

1. IEEE 1451 Smart Transducer Standard for HVAC Applications
   Darold Wobschall, Ph.D., Esensors Inc., Amherst, NY

2. IEEE 1451.4 and TEDS for Smart Measurement and Control Systems
   David Potter, National Instruments, Austin, TX

3. Automated Correction of Sensor Faults
   Michael R. Brambley, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA

Including Sustainability in Museums, Galleries, Archives and Libraries: Applications Handbook Chapter

As the TC begins to revise the 2007 Applications Handbook Chapter 21, Museums, Galleries, Archives and Libraries, comments are sought from the
membership to help improve it. The museums chapter is an important resource for engineers designing HVAC systems since the criteria and set points must be for the preservation of the collection and not human comfort. We are not incorporating information about sustainability and green museums. We are soliciting ideas for the CD+. Come and provide input for this chapter or just come to learn about museums.

Sunday, 1/25,
1:30 p.m.–3 p.m.

Transactions Session 4 (Intermediate)

State of the Art and Future Refrigerant Flow Control Technologies

Track: Refrigeration

Adams (6)
Sponsor: 8.8 Refrigerant System Controls and Accessories
Chair: Robert Bittle, Member, Texas Christian University, Ft. Worth, TX

TC 8.8 has invited papers reporting on the latest experimental and theoretical research related to refrigerant flow control technologies found in refrigeration and A/C systems. The session target audience is A/C and refrigeration system design engineers and researchers interested in current research efforts focused on flow control device performance from both an experimental and theoretical point of view.

1. Experimental Investigation on the Flow of R-134a through Adiabatic and Diabatic Capillary Tubes (CH-09-011)
Mo Khan, Ph.D., Thapar University Patiala, Patiala, India; Ravi Kumar, Ph.D., Associate Member; Pradeep K. Sahoo, Ph.D., Member, Indian Institute of Technology Roorkee, Roorkee, India

2. Performance Prediction of Adiabatic Capillary Tubes by Conventional and ANN Approaches: A Comparison (CH-09-012)
Mo Khan, Ph.D., Thapar University Patiala, Patiala, India; Ravi Kumar, Ph.D., Associate Member; Pradeep K. Sahoo, Ph.D., Member, Indian Institute of Technology, Roorkee, India

Sunday, 1/25, 1:30 p.m.–3 p.m.

Transactions Session 5 (Basic)

The History of Cold

Track: Systems and Equipment

Monroe (6)
Sponsor: Historical Committee, 10.5 Refrigerated Distribution and Storage Facilities
Chair: Daniel J. Dettmers, Member, University of Wisconsin, Madison, WI

This Transactions Session provides three papers on the history of refrigeration from ancient times to birth of modern history brought to you by authors from across the globe. This session will delight anyone with interest in HVAC, refrigeration or history.

1. Chillin’ at the Symposium with Plato: Refrigeration in the Ancient World (CH-09-013)
Richard Love, Ph.D., Member, Massey University, Palmerston, New Zealand

2. Lessons Learned from the Cold Storage Fire at the World’s Fair, Chicago, 1893 (CH-09-014)
Andy Pearson, Ph.D., Member, Star Refrigeration, Ltd., Glasgow, United Kingdom

3. Was Ice Making John Gorrie’s Greatest Legacy? (CH-09-015)
Bernard Nagengast, Member, Consultant, Sidney, OH

Sunday, 1/25, 1:30 p.m.–3 p.m.

Seminar 12 (Advanced)

Advances in Supermarket Display Case Technology: Analytical Tools and Test Results

Track: Refrigeration

Empire (L)
Sponsor: 10.7 Commercial Food and Beverage Cooling Display and Storage
Chair: Van Baxter, P.E., Member, Oak Ridge National Laboratory, Oak Ridge, TN

This seminar presents current results of a project to develop improved technology for open vertical supermarket display case air curtains. The overall goal is to reduce infiltration of ambient store air into the display case evaporator air stream. First presented are results from a carbon dioxide tracer gas technique to measure total air flow and ambient air infiltration in open vertical case platforms. Second, an advanced analytical tool based on the neural network technique to predict infiltration rates for a range of air curtain parameters. Finally results of tests performed on a display case equipped with an air curtain design developed using the neural network tool are presented.

1. Using CO2 Tracer Gas Technique to Measure Total Air Flow and Infiltration Rates in Open Vertical Display Cases
Mazyar Amin, Student Member; Dana Dabiri, Ph.D., University of Washington, Seattle, WA

2. Application of the Neural Network Technique in Predicting Infiltration Rates of Open Vertical Display Cases
Homayun Navaz, Ph.D., Member, Kettering University, Flint, MI

3. Thermal Performance of an Open Vertical Display Case with Improved Air Curtain System
Ramin Faramarzi, P.E., Member, Southern California Edison, Irwindale, CA
Air Filtration for Sustainable Buildings

Track: Sustainability
Wabash (3)
Sponsor: 2.4 Particulate Air Contaminants and Particulate Contaminant Removal Equipment
Chair: Robert Burkhead, Member, Blue Heaven Technologies, Louisville, KY

Particle filtration is critically important for the protection of building occupants, HVAC equipment, and indoor surfaces. However, in order to consider the sustainability of filtration equipment, many factors need to be considered in addition to just the filtration efficiency and capacity. These factors include energy costs associated with filtration, lifecycle costs, productivity impacts associated with filtration, and chemical reactions that occur on filter surfaces.

The purpose of this seminar is to present state-of-the-art research on these topics with the goal of providing insight to the ASHRAE membership on the integration of filters into sustainable buildings.

1. Costs and Benefits of Particle Filtration
   Gabriel Beko, Technical University of Denmark, Lyngby, Denmark

2. Suppressing Sensory Pollution from Filters
   Pawel Wargocki, Ph.D., Technical University of Denmark, Lyngby, Denmark

3. Surface Chemistry in HVAC Filters: Ozone Deposition and Secondary Pollutant Yields
   Hugo Destaillats, Ph.D., Lawrence Berkeley National Laboratory, Berkeley, CA

4. Delivering Sustainability Promise to HVAC Air Filtration
   Christine Sun, Ph.D., Member, and Dan Woodman, Freudenberg Nonwovens, Hopkinsville, KY

Application of ASHRAE Standards and Guidelines to Improve the Sustainability of Data Centers, Part 1

Track: Sustainability
Crystal (3)
Sponsor: 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment
Chair: Michael K. Patterson, Ph.D., P.E., Member, Intel, Hillsboro, OR

Data Centers represent a significant challenge to owner/operators and designers because of the increasing computational power that can be put into smaller and smaller spaces. These high densities are unlike the majority of commercial or industrial spaces and require advanced engineering to provide cooling in an efficient manner. This seminar looks at how the sustainability of data centers can be improved by the application of the recently updated ASHRAE recommended thermal guidelines for Data Center environments. In addition ASHRAE standards that relate to Data Centers are reviewed and their energy efficiency impacts will be discussed.

1. History, Overview, and Improved Sustainability with the 2008 ASHRAE Thermal Guidelines
   Roger Schmidt, Ph.D., P.E., Fellow, IBM, Poughkeepsie, NY

2. Implications of the 2008 Thermal Guidelines to the Server Manufacturer
   Michael Patterson, Associate Member, Intel Digital Enterprise Group, Portland, OR

3. Implications of the 2008 Thermal Guidelines to the Architect and Engineer
   Vali Sorell, Syska Hennessy Group, Charlotte, NC

4. Implications of the 2008 Thermal Guidelines to the End User
   Christian Belady, Associate Member, Microsoft Corp., Redmond, WA

CFD Simulations of Air Distributions in Buildings: Past, Present and Future

Track: Indoor Environmental Topics
Red Lacquer (4)
Sponsor: 4.10 Indoor Environmental Modeling
Chair: Qingyan Chen, Ph.D., Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN

In order to design a comfortable, healthy, sustainable, and safe building, it is important to know the distributions of air velocity, air temperature, relative humidity, the temperature of the surroundings, and concentrations of airborne gaseous, particulate, and liquid droplet contaminants in the building. Nowadays a common approach is using a computer model to compute air distribution in buildings, and performing limited but dedicated experimental measurements to obtain high quality data to validate the computer models. If the main features of the computer model are validated,
one can then trust the computer results. In many cases, one would find that the computed results do not agree with the corresponding experimental data. In this scenario, only you will believe your results if you use computer models, and everyone except for you will believe your results if you measure air distribution. Is this really the case? This seminar is trying to find out the answer.

1. Evaluation of Various Turbulence Models in Predicting Airflow and Turbulence in Enclosed Environments by CFD
   John Zhai, Ph.D., Member, University of Colorado at Boulder, Boulder, CO; Zhao Zhang, Ph.D., Student Member; Wei Zhang, Ph.D., Member; Qingyan Chen, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN
   Wangda Zuo, Student Member; Qingyan Chen, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN
   2. Evaluation of Various Turbulence Models in Predicting Airflow and Turbulence in Enclosed Environments by CFD
   3. Real Time Simulation for Airflow Motion and Contaminant Transportation in Buildings

Sunday, 1/25, 1:30 p.m.–3 p.m.

Seminar 16 (Basic)

Sustainability of HVAC Systems in Extreme Events in Urban Areas
Track: Applications
Water Tower Parlor (6)
Sponsor: 2.7 Seismic and Wind Restraint Design
Chair: Doug Fitts, Member, Fitts HVAC Consulting, LLC, Sunrise Beach, MT

This seminar discusses what happens to HVAC systems during extreme events in urban areas and how to protect them. Earthquakes and bomb blasts and the steps that need to be taken to protect those systems are addressed.

1. HVAC Systems in a Rock and Roll World: Seismic Resilience for Your Building
   Jay Lewis, Terra Firma Earthquake Preparedness, Inc., Vancouver, BC, Canada
2. Blast Resistant Design of HVAC Systems
   Scott D. Campbell, P.E., Member, Kinetics Noise Control, Louisville, KY

Sunday, 1/25, 1:30 p.m.–2:30 p.m.

Seminar 17 (Basic)

First Time at an ASHRAE Meeting? This Seminar’s for You!
Track: Fundamentals
Salons 8/9 (3)
Sponsor: Conferences and Expositions Committee
Chair: Ginger Scoggins, P.E., Member, Engineered Designs Inc., Raleigh, NC

OPEN SESSION: no badge required

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

1. Technical Committees, Standing Committees and Programs
   James Crawford, Fellow ASHRAE, Trane, Tyler, TX
2. How to Get the Most (Fun) Out of ASHRAE
   Joseph S. Ferdelman, P.E., Member, Heapy Engineering, Dayton, OH
3. Young Engineers in ASHRAE (YEA)
   Larry Sun, P.E., Member, Tsuchiyama, Kaino Sun & Carter, Irvine, CA

Sunday, 1/25, 3:15 p.m.–4:45 p.m.

Seminar 18 (Intermediate)

ASHRAE’s Newest Standard: 189.1P High Performance Green Buildings for a Sustainable Future
Track: Sustainability
Red Lacquer (4)
Sponsor: Standards Committee, 2.8 Building Environmental Impacts and Sustainability
Chair: Kent Peterson, P.E., Presidential Fellow Member, P2S Engineering, Inc., Long Beach, CA
ASHRAE 189.1P is a standard that is being written for “High Performance Green Buildings.” It is being sponsored by three organizations—ASHRAE, USGBC and IESNA. It has gone through two public reviews and is nearing its final phase. This seminar discusses the framework and key elements of the
standard, compares the standard to LEED and discusses the integration into the LEED program, reviews the energy modeling supporting the energy efficiency requirements and then walks through the design of a building to identify where changes would have to be made.

1. What Is ASHRAE 189.1P? The Framework and Key Elements
Katherine Hammack, Member, Ernst & Young LLP, Phoenix, AZ

2. Integration of Standard 189.1P with LEED
Brendan Owens, Affiliate, USGBC, Washington, D.C.

Drury B. Crawley, Member, U.S. Department of Energy, Washington, DC

4. LEED-NC (Retail) vs. ASHRAE 189.1P–Similarities and Differences in an Actual Application
Anthony J. Spata, Member, Hyatt Hotels Corp., Chicago, IL

Sunday, 1/25, 3:15 p.m.–4:45 p.m.

Seminar 19 (Intermediate)

Application of ASHRAE Standards and Guidelines to Improve the Sustainability of Data Centers, Part 2

Track: Sustainability
Crystal (3)
Sponsor: 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment
Chair: Michael Patterson, Associate Member, Intel Digital Enterprise Group, Portland, OR

Data centers represent a significant challenge to owner/operators and designers because of the increasing computational power that can be put into smaller and smaller spaces. These high densities are unlike the majority of commercial or industrial spaces and require advanced engineering to provide cooling in an efficient manner. This seminar looks at how the sustainability of data centers can be improved by the application of the recently updated ASHRAE recommended thermal guidelines for data center environments. In addition ASHRAE standards that relate to data centers are reviewed and their energy efficiency impacts are discussed.

1. ASHRAE Standard 90.1 and Data Centers
Mark Hydeman, P.E., Fellow ASHRAE, Taylor Engineering Inc., Alameda, CA

2. ASHRAE Standard 127’s Implications for Sustainable Data Centers
J. F. Stack, Associate Member, Emerson Network Power, Columbus, OH

3. Data Center Rating Systems for Improved Energy Efficiency: LEED, Energy Star, DOE and Others
William Tschudi, Member, Lawrence Berkeley National Laboratory, Walnut Creek, CA

Sunday, 1/25, 3:15 p.m.–4:45 p.m.

Seminar 20 (Intermediate)

How to Identify a Good Urban CHP Project

Track: High Performance Systems
Salons 8/9 (3)
Sponsor: TC 8.3 Absorption and Heat Operated Machines
Chair: Richard Sweetser, Member, Exergy Partners Corp., Herndon, VA

Combined Heat and Power (CHP) systems are a sustainable solution being applied in energy constrained urban centers. New York City offices are applying CHP to provide secure data centers within their buildings, to reduce overall energy cost and because their electric utility’s supply and distribution system is under severe constraints. Development of Chicago’s CHP development has slowed, but entities like Illinois Institute of Technology are pursuing CHP as an answer for the future. So, what makes a good urban CHP system? The U.S.EPA CHP Partnership has developed a project development primer that will be presented and two experts in developing CHP projects in Chicago and New York propose to reveal their methods of developing successful projects.

1. EPA’s CHP Partnership CHP Project Primer: Developing a Successful Project
Bruce Hedman, ICF, Arlington, VA

2. Project Development of a Successful Chicago CHP System
John Cuttica, Midwest CHP Application Center, Chicago, IL

3. Project Development of a Successful New York City CHP System
Greg Rouse, Endurant Energy, Oakbrook Terrace, IL
MONDAY, 1/26,
8 a.m.–9:30 a.m.

MONDAY

- Let’s get together – contractors, engineers and owners collaborate on sustainable projects
- Liquid cooling and evaporative cooling applications sessions for data centers
- More buildings sessions – energy efficiency labeling and mechanical systems in high rise buildings
- AHR Expo opens, see the public session on “Sustainability in the Urban Environment” held at McCormick Place

Monday Sessions held at the Palmer House Hilton

Transactions Session 6 (Intermediate)

Improving Load Calculations for Fenestrations with Shading Devices (RP-1311)

Track: Fundamentals

Crystal (3)
Sponsor: 4.1 Load Calculation Data and Procedures, 4.7 Energy Calculations, 4.5 Fenestration
Chair: Glenn Friedman, P.Eng., Member, Taylor Engineering, Alameda, CA

Research Project 1311-RP, Improving Load Calculations for Fenestrations with Shading Devices, researched the effects of shading on fenestration loads and destroys myths that shading always reduces peak loads.

1. Determining Off-Normal Solar Optical Properties of Roller Blinds (CH-09-017)
   Nathan A. Kotey, Student Member; John L. Wright, P.Eng., Member; Michael R. Collins, Member, University of Waterloo, Waterloo, ON, Canada

2. Determining Off-Normal Solar Optical Properties of Insect Screens (CH-09-018)
   John L. Wright, P.Eng., Member; Nathan A. Kotey, Student Member; Michael R. Collins, Member, University of Waterloo, Waterloo, ON, Canada

3. A Detailed Model to Determine the Effective Solar Optical Properties of Draperies (CH-09-016)
   Nathan A. Kotey, Student Member; John L. Wright, P.Eng., Member; Michael Collins, Member, University of Waterloo, Waterloo, ON, Canada

Monday, 1/26, 8 a.m.–9:30 a.m.

Seminar 21 (Intermediate)

2007 Solar Decathlon Award-Winning Designs

Track: Sustainability

Red Lacquer (4)
Sponsor: 6.7 Solar Energy Utilization
Chair: Janice K. Means, P.E., Member, Lawrence Technological University, Southfield, MI

Representatives from the three winning university teams for the international 2007 Solar Decathlon Competition present overviews of their designs, their integration of technical innovations, and insight on how to create off-grid sustainable residential structures.

1. University of Maryland’s 2007 Solar Decathlon House: Overview, Design, Technologies and Challenges for the 2nd Place Design
   Kaye L. Brubaker, Ph.D., University of Maryland, College Park, College Park, MD

2. Santa Clara University’s 2007 Solar Decathlon House: Overview, Design, Technologies and Challenges for the 3rd Place Design
   Jorge E. Gonzalez, Ph.D., Member, Santa Clara University, Santa Clara, CA
Seminar 22 (Basic)

CO₂ Sensors and Demand-Controlled Ventilation

Track: Indoor Environmental Topics

Empire (L)

Sponsor: 1.4 Control Theory and Application

Chair: Chariti Young, Member, Automated Logic Corp., Kennesaw, GA

From lab tests, to field tests, to real-life applications, the seminar examines the efficacy of and challenges related to demand-controlled ventilation.

1. Performance Evaluation of CO₂ Sensors for Demand Controlled Ventilation
Som S. Shrestha, Student Member; Gregory M. Maxwell, Ph.D., Member, Iowa State University, Ames, IA

2. Carbon Dioxide Sensors Used for Demand Controlled Ventilation: Accuracy in Real Installations.
William Fisk, P.E., Fellow ASHRAE, Lawrence Berkeley National Laboratory, Berkeley, CA

3. CO₂ DCV Control Strategies
Steven T. Taylor, P.E., Fellow ASHRAE, Taylor Engineering, Alameda, CA

Seminar 23 (Intermediate)

Case Studies in Sustainable Foodservice Facility Design

Track: Sustainability

Adams (6)

Sponsor: 5.10 Kitchen Ventilation

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

Foodservice industry energy initiatives date from the 1970’s, and they’ve accelerated in the past few years with research by ASHRAE and others, as well as significant field experiences of design professionals, manufacturers, and restaurant developers. This seminar highlights case studies in sustainable designs by several restaurant chains and one supermarket.

1. Setting the Stage for Green Restaurants
Don Fisher, P.Eng., Associate Member, Fisher-Nickel, San Ramon, CA

2. E3: Sustainable Restaurant Design and Development
David Harpring, YUM! Brands, Louisville, KY

3. Sustainable Design Advancements in Chain Restaurants
Francis J. Kohout/ Jason Greenberg, McDonald’s Corp., Oak Brook, IL

4. ‘Greening’ Supermarket Foodservice Facilities
Robert Ajemian, Member, Green Kitchen Designs, New York, NY

Seminar 24 (Intermediate)

HVAC&R Research Seminar, Part 1

Track: Fundamentals

Water Tower Parlor (6)

Sponsor: HVAC&R Research

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

Authors who have recently published in the HVAC&R Research publication present their papers and have a Q&A session.

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

2. Evolutionary Synthesis of HVAC System Configurations: Experimental Results
Johnathan A. Wright, Ph.D., Member, Loughborough University, Loughborough, Leicestershire, United Kingdom

Yunho Hwang, Ph.D., University of Maryland, College Park, MD
Monday, 1/26, 8 a.m.–9:30 a.m.

Seminar 25 (Intermediate)

How Can Contractors Succeed in a Sustainable World?: Clarifying the Expectations of an Engineer, Contractor and Owner to Deliver a Sustainable Project

Track: Sustainability

Wabash (3)

Sponsor: TG3 HVAC&R Contractors and Design Build Firms (CDBF)

Chair: George W. Austin, Jr., P.E., Member, David Shultz Associates, Charlotte, NC

Case study with presentations from the engineer, contractor and owner on the expectations and results of delivering a successful sustainable project.

1. Clarifying Expectations to Deliver a Sustainable Project

Julie DeNardis, Environmental Systems Design, Inc., Chicago, IL; Steve Wright, Wright Heerema, Chicago, IL; Ceile Cull, Pepper Construction, Chicago, IL; and Bill Haidy, HSBC, Chicago, IL

Monday, 1/26, 8 a.m.–9:30 a.m.

Seminar 26 (Intermediate)

New Lab Air Change Rate Research and Impact on Lab Building Performance

Track: Applications

Monroe (6)

Sponsor: 9.10 Laboratory Systems

Chair: Gordon P. Sharp, Member, Aircuity, Inc., Newton, MA

The largest known study of lab IEQ conditions and the energy impact of dynamic control of lab ACH rates is presented along with theoretical and empirical research on the validity of specifying lab air change rates as a measure of lab building performance.

1. A Review of the IEQ and Energy Impact on Lab Building Performance of Dynamically Varying Air Change Rates at Multiple Lab Facilities

Gordon P. Sharp, Member, Aircuity, Inc., Newton, MA

2. The Effect of Air Change Rate on Recovery from a Spill

Glenn Schuyler, Member, RWDI, Guelph, ON, Canada

Monday, 1/26, 8 a.m.–9:30 a.m.

Seminar 27 (Basic)

Actions in Europe to Improve Energy Efficiency of Buildings

Track: Applications

Salons 8/9 (3)

Sponsor: ASHRAE Associate Society Alliance

Chair: Francis Allard, Member, University of La Rochelle, France

This seminar provides an overview of the most important actions European commissions and some other European organizations have taken to reduce greenhouse gas emissions in the building sector and addresses the labeling of buildings with respect to environmental impact. The European commission has set a goal to reduce emissions by 20% by the year 2020, and also increase the share of renewables by 20%. The presentations deal with energy policy and technology.

1. European Policy, Directives and Supporting Actions to Improve Energy Efficiency of Buildings

Olli Seppänen, Ph.D., Fellow ASHRAE, Federation of European Heating and Air-Conditioning Associations (REHVA)


Francis Allard, Ph.D, Member, University of La Rochelle, France

3. EPBD Buildings Platform: An Open Platform to Disseminate Energy Efficiency Related Information

Ioan Dobosi, P.E., Ph.D., Member, Dosetimpex, Timisoara, Romania

4. European CEN-Standards to Improve Energy Efficiency of Buildings

Jaap J. Hogeling, Member, ISSO, Lienden, Netherlands
**Forum 2 (Intermediate)**

**Energy Savings with In-Duct UV-C**

**Track: Operational Topics**

**Dearborn 1 (7)**

**Sponsor: 2.9 Ultraviolet Air and Surface Treatment**

**Chair: David Marciniak, P.E., Member, GSA, Washington, DC**

It is well documented that C-band ultraviolet radiation (UV-C) is effective in preventing microbial growth on surfaces, particularly air handling unit coils. However, better quantification of energy and maintenance benefits is needed to accurately calculate sustainable benefits and life cycle costs. Much of the current body of knowledge is anecdotal and performance data is complicated by changing environmental conditions and HVAC system responses. TC 2.9 is pursuing a research initiative to compare the long-term performance of standard new coil installations to coils irradiated with UV-C. This forum allows discussion of the proposed approach, the installation, the parameters to be measured, and the performance indicators desired.

**MONDAY, 1/26,**

**9 a.m.–9:45 a.m.**

**Forum 3 (Basic)**

**Do We Need a New Handbook Chapter for High Rise and Mixed Use Facilities?**

**Track: Applications**

**Grant Park (6)**

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

**Chair: Robert L. Cox, P.E., Member, Jacobs Carter Burgess, Cary, NC**

The current Handbook chapters do not currently address the trend of multi-use facilities frequently containing central plant facilities, entertainment or retail facilities and condominium or apartments as well as hotels.

**MONDAY, 1/26,**

**9 a.m.–10 a.m.**

**Forum 4 (Intermediate)**

**Fan Pressure and Efficiency: What Should Be Used, Static or Total?**

**Track: Systems and Equipment**

**Hancock (6)**

**Sponsor: 5.1 Fans, 5.9 Enclosed Vehicular Facilities**

**Chair: John Cermak, Ph.D., Member, ACME Engineering and Manufacturing, Tulsa, OK**

Discussions are centered on the issue of specifying fan pressure and efficiency.

**MONDAY, 1/26,**

**9:45 a.m.–10:45 a.m.**

**Transactions Session 7 (Intermediate)**

**Smoke Control and Evacuation in High Rise Buildings**

**Track: Fundamentals**

**Wabash (3)**

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

**Chair: Gary Lougheed, Ph.D., Member, National Research Council Canada, Ottawa, ON, Canada**

The session discusses smoke control in high-rise buildings and evacuation plans for tall buildings. For tall buildings, stack effect is the main driving force that can produce smoke movement in the building including into evacuation routes. A model for determining the vertical smoke movement in a building and the effects of floor pressurization to manage smoke movement in a building are discussed. In addition, the use of evacuation plans to aid in the safe evacuation of occupants in tall buildings is presented.

1. **Use of Air Handling Equipment to Manage Smoke Movement During a High-Rise Fire (CH-09-019)**

   **William Z. Black, Ph.D., Member, Georgia Institute of Technology, Atlanta, GA**

2. **Evacuation Plans for Tall Buildings (CH-09-020)**

   **Jeffrey Tubbs, P.E., Member, ArupFire, Westborough, MA**
Transactions Session 8 (Intermediate)

Filter Bypass: Measurements and Implications
Track: Applications
Salons 8/9 (3)
Sponsor: 2.4 Particulate Air Contaminants and Particulate Contaminant Removal Equipment
Chair: John M. Chimack, Member, Energy Resources Center, North Aurora, IL

Given the high level of interest and limited research work completed in air filter bypass, this session discusses how bypass affects air filter efficiency and ultimately indoor air quality. An ASHRAE 52.2 compliant test loop was used to study bypass on air filters ranging from MERV2 to MERV 14 by varying gap sizes and geometries. In addition, actual air filter bypass degradation was measured in 13 air filter installations in residential, light commercial and large institutional buildings. Both the laboratory and field test results of air filter bypass are presented.

1. Implications of Filter Bypass (CH-09-021)
Jeffrey A. Siegel, Member; John R. VerShaw, Student Member, The University of Texas at Austin, Austin, TX; David B. Chojnowski, Member; Paul J. Nigro, Student Member, University of Illinois at Chicago, Chicago, IL

2. Laboratory Measurements to Quantify the Effect of Bypass on Filtration Efficiency (CH-09-022)
Paul J. Nigro, Student Member; David B. Chojnowski, Member; University of Illinois at Chicago, Chicago, IL; Jeffrey A. Siegel, Ph.D., Member, University of Texas at Austin, Austin, TX; Douglas R. Kosar, Associate Member, University of Illinois at Chicago, Chicago, IL

HVAC&R Research Seminar, Part 2
Track: Fundamentals
Water Tower Parlor (6)
Sponsor: HVAC&R Research
Chair: Reinhard Radermacher, Ph.D., Fellow ASHRAE, University of Maryland, College Park, MD

Authors who have recently published in the HVAC&R Research publication present their papers and have a Q&A session.

1. The Transient Response of Capacitive Thin-Film Polymer Humidity Sensors
Brandon Dooley, Texas A&M University, College Station, TX

2. Modeling of a Two-Stage Rotary Compressor
Margaret M. Mathison, Student Member, Purdue University, West Lafayette, IN

Innovations in Mechanical Systems for High Rise Buildings
Track: High Performance Systems
Monroe (6)
Sponsor: 9.12 Tall Buildings
Chair: Peter Simmonds, Ph.D., Fellow ASHRAE, IBE Consulting Engineers, Sherman Oaks, CA

Chicago has many high rise buildings that have been recently constructed or are currently under design. The presenters have been involved in these designs and present the latest trends and philosophies of high-rise building design.

1. HVAC System on Spire
Doug Mass, Member, Cosentini Consulting Engineers, Chicago, IL

2. The Mechanical Systems for the Trump Tower
Robert Tazelaar, P.E., Member, WMA Consulting Engineers, Chicago, IL

Forum 5 (Intermediate)

Limitation of Energy Simulation for NZEB
Track: Applications
Empire (L)
Sponsor: 4.7 Energy Calculations
Chair: Timothy P. McDowell, Member, Thermal Energy System Specialists, LLC, Madison, WI

The design of near zero energy buildings (NZEB) and other high performance buildings require advanced building and HVAC system simulation to estimate their energy usage. The current energy simulation tools are limited in what they are able to model correctly. This forum discusses the current limitations and allows for feedback from the engineering community on where improvements in the current programs can be made.
Monday, 1/26, 9:45 a.m.—10:45 a.m.

Forum 6 (Intermediate)

Performance of Heat Pipes with New Alternative Refrigerants

Track: Systems and Equipment

Red Lacquer (4)

Sponsor: 8.10 Mechanical Dehumidification Equipment and Heat Pipes, 3.1 Refrigerants and Secondary Coolants

Chair: Samuel Sami, Ph.D., P.E., Fellow ASHRAE, University of Moncton, Moncton, NB, Canada

This forum examines the basic principles of heat pipe performance using new alternative refrigerants and their impact on heat recovery efficiency.

Monday, 1/26, 9:45 a.m.—10:45 a.m.

Forum 7 (Intermediate)

Thermodynamics of Sustainable Urban Energy Systems

Track: Sustainability

Crystal (3)

Sponsor: 1.1 Thermodynamics and Psychrometrics

Chair: Laura Schaefer, Ph.D., Associate Member, University of Pittsburgh, Pittsburgh, PA

Sustainability has received increasing attention in recent years. In implementing truly sustainable structures, it is important to establish a strong fundamental basis for their thermodynamic performance and efficiency. This is especially relevant in an urban environment, where the influence of a new or retrofitted structure extends beyond the behavior of the structure itself.

Monday, 1/26, 9:45 a.m.—10:45 a.m.

Forum 8 (Intermediate)

GSHP Performance and Costs: What Do We Know and What Do We Need to Know?

Track: Systems and Equipment

Adams (6)


Chair: Steve Kavanaugh, Ph.D., Fellow ASHRAE, University of Alabama, Tuscaloosa, AL

This forum provides an opportunity for interested parties to share known sources of measured performance results and installation costs of GSHPs. GSHP systems costs for educational buildings have been reported as low as $13/ft² and as high as $45/ft² with no apparent correlation between installation and operating costs. A design team conducted Life Cycle Cost Analysis for a 19,000 ft² university welcome center using a cost of $48/ft² which resulted in a $985 annual savings with a 62-year simple payback compared to a VAV system with an air-cooled chiller. The New Buildings Institute completed a study to locate measured energy use of at least 100 buildings that exceed energy code consumption by at least 50%. GSHPs served 20% of these buildings even though the market penetration of GSHPs is less than 1%. Obviously, the data for this technology is somewhat scattered.

MONDAY, 1/26, 11 a.m.—Noon

Transactions Session 9 (Intermediate)

Case Studies of Two Diverse Combined Heat and Power (CHP) Integrated Systems

Track: Applications

Crystal (3)

Sponsor: 1.10 Cogeneration Systems, 8.3 Absorption and Heat Operated Machines

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

Combined heat and power (CHP) systems are as diverse as their applications. This session covers two different CHP solutions to two very different applications. The first installation involves the integration of a microturbine based cooling and power system into a San Francisco landmark hotel. This site provides important insight into grid network interconnection, CHP thermal sizing and electrical/thermal building level integration. The second site recovers waste heat from a gas turbine exhaust using an organic Rankine cycle-based generator. This paper provides performance insight into this 5.5 MW system that was designed to provide competitively priced electricity and VAR support to the electric grid.

1. Cooling, Heating, and Power Using Microturbines in a Major Urban Hotel (CH-09-023)

Timothy Wagner, United Technologies Research Center, East Hartford, CT; Neil Leslie, Gas Technology Institute, Des Plaines, IL; Therese Stovall, Oak Ridge National Laboratory, Oak Ridge, TN
Liquid Cooling Issues Update: January 2009

The IT community, and those of us that support that community through the design and provision of infrastructure support products and services, continues to search for solutions to the problems associated with high heat densities resulting from increased compaction of the heat load in the data center. One area of interest is in the use of various methodologies of liquid cooling. This session presents several current trends of utilizing liquids for the purpose of heat rejection. Research and development is ongoing with the major industry leaders devoting significant resources to this area of study.

1. Liquid Cooling in Data Centers (CH-09-025)
   Tahir Cader, Ph.D., Spray Cool Inc., Liberty Lake, WA; Vali Sorell, P.E., Syska Hennessy Group, Charlotte, NC; Levi Westra, Spray Cool Inc., Liberty Lake, WA; Andres Marquez, Ph.D., Pacific Northwest National Laboratory, Richland, WA

2. Real-Time Data Center Energy Efficiency at Pacific Northwest National Laboratory (CH-09-026)
   Daniel R. Sisk; Mohammad A. Khaleel, Ph.D.; Andres Marquez, Ph.D.; Darrel Hatley, Pacific Northwest National Laboratory, Richland, WA; Tahir Cader, Ph.D., Spray Cool Inc., Liberty Lake, WA; Roger Schmidt, Ph.D., P.E., Fellow, IBM, Poughkeepsie, NY

Design and Acceptance Criteria for Smoke Control Systems

Smoke control systems are required by code to be present in certain types of buildings or portions of buildings, based on the use of that building or space. When properly designed and installed, these systems help to protect building occupants during a fire or smoke emergency. This seminar addresses the design requirements applicable to various components of a smoke control system, and discusses the process used to commission smoke control systems to ensure that all of the component parts work together as intended. Building codes are now requiring the components and completed system to be tested by a “special inspector.” The role of the “special inspector” during the various phases of the project is also described.

1. Component Requirements for Smoke Control Systems
   Robert Van Becelaere, Member, Ruskin, Kansas City, MO

2. Commissioning Smoke Control Systems
   Larry Felker, Member, Belimo Americas, Sparks, NV

3. Role of the Special Inspector for Smoke Control Systems
   John A. Clark, P.E., Fellow Life Member, KFI Engineers, St. Paul, MN

Sustainability Re-sustained: Lessons to Be Learned from Solar Technologies in Buildings in Recent Times

We have entered an era where there is a rekindled interest in solar technologies. This session examines solar technologies which have emerged since the 1970’s for lessons learned and what may contribute to current developments in the industry.

1. Pioneering Use of Evacuated Tube Solar Collectors and Early Direct Digital Control Systems
   Richard Pearson, P.E., Member, Pearson Engineering, Madison, WI; Rick Pavlak, Member, Heapy Engineering, Dayton OH

2. Notes on the History of the Solar House
   Anthony S. Denzer, Member, University of Wyoming, Laramie, WY
Monroe (6)
Sponsor: 4.4 Building Materials and Building Envelope Performance
Chair: Sean M. O’Brien, P.E., Member, Simpson Gumpertz & Heger, Inc., New York, NY

Buildings in the U.S. are responsible for nearly 50% of the total, nationwide energy consumption and approximately 35% of total CO2 emissions. Further, CO2 production from buildings is increasing at a greater rate than both industry and transportation. If these trends continue, leaky and poorly insulated buildings may soon be seen as the “gas guzzlers” of architecture. Whole building energy design takes into account all aspects of the building envelope and building systems, allowing designers to predict the interaction between occupants, lighting and plug loads, mechanical systems, and walls, roofs, and enclosure components. This session describes the basic elements of a whole building simulation and use case studies and examples to illustrate the impacts of both minor and major changes on the overall energy use of buildings.

1. An Introduction to Whole Building Energy Simulation
Sean M. O’Brien, P.E., Member, Simpson Gumpertz & Heger, Inc., New York, NY

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

Water Tower Parlor (6)
Sponsor: 6.6 Service Water Heating
Chair: Harvey M. Sachs, Ph.D., Member, ACEEE, Washington, DC

The current U.S. method for rating water heater efficiency has been in use long enough that its defects are well-known. It is hard to get reproducible values for the energy factor, EF, particularly for gas-fired equipment. While the rating method may give good comparisons within a single class, particularly tank-type water heaters, comparisons with other classes are uncertain—probably biased, making customer choice difficult. Water heaters of all capacities are rated on the assumption that all residences require the same 66.4 gal/day of hot water. The tank temperature of 135°F works against most heat pump water heaters. ASHRAE 118.2 is considering changes that would lead to easier testing, allow more robust comparisons and encourage innovation for efficiency.

Wabash (3)
Sponsor: 10.3 Refrigerant Piping
Chair: Jim Young, Jr, Member, Dow Chemical Co., Midland, MI

Chapter 33 of the Refrigeration Handbook covers insulation systems for use on refrigerant pipe. This chapter contains a number of tables showing pipe insulation thickness necessary to achieve condensation control and limit the heat gain to 8 Btu/hr-ft² of outer insulation jacket. This 8 Btu heat gain limit is a “rule-of-thumb” developed many years ago and is widely applied to insulation design for all below ambient applications. Given the change in many factors, most notably the increased cost of energy, is this 8 Btu/hr-ft² heat gain limit still appropriate for below ambient piping?

Empire (L)
Sponsor: 5.4 Industrial Process Air Cleaning (Air Pollution Control), 9.2 Industrial Air Conditioning
Chair: Wayne M. Lawton, P.E., Member, Merrick, Aurora, CO

Industrial facilities are included in ASHRAE Standard 62.1; however the requirements are very limited. The purpose of this forum is to help determine what the Society needs to be covered in the standard.
MONDAY, 1/26, 2:00 p.m.–3:00 p.m.
Forum 12 (Intermediate)

Demand Response: What Is In It for You!
Track: High Performance Systems
Grant Park (6)
Sponsor: 7.5 Smart Building Systems
Chair: Carlos Haiad, MS, P.E., Associate Member, Southern California Edison, Irwindale, CA

New and innovated demand response programs, which leverage the growing deployment of smart electric meters with real-time, two-way communication capabilities, present design engineers, controls vendors and building operators with increasing opportunities to provide solutions not only to save money, but potentially make money. This forum discusses the current and emerging demand response programs and how designers and building operators can benefit from it.

MONDAY, 1/26, 2:15 p.m.–3:45 p.m.
Seminar 34 (Basic)

GSHP Systems in Urban Environments
Track: Sustainability
Crystal (3)
Sponsor: 6.8 Geothermal Energy Utilization
Chair: James G. MacMillan, PE, Member, Karpinski Engineering, Cleveland, OH

The program presents the challenges and successes associated with applying ground source heat pump systems in urban environments.

1. Design Considerations for GSHP Systems in Urban Settings
James G. MacMillan, PE, Member, Karpinski Engineering, Cleveland, OH
2. Central Plant Geothermal: It’s Not Just Unitary Anymore
Steve Hamstra, P.Eng., Member, GMB Architects-Engineers, Holland, MI
3. 25 Years of Geothermal Heat Pumps in Manhattan and Boroughs
Carl Orio, Member, Water Energy Distributors, Inc., Plaistow, NH

Monday, 1/26, 2:15 p.m.–3:45 p.m.

Seminar 35 (Advanced)

Greener Data Centers through Evaporative Cooling
Track: High Performance Systems
Salons 8/9 (3)
Sponsor: 5.7 Evaporative Cooling
Chair: Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV

Data centers have become increasingly critical as the hubs of our expanding electronic and cyber world society. However, data centers, of necessity, are energy intensive in order to provide optimal performance in their operation. Such high performance requirements, however, do not preclude the use of design strategies and technologies which can drastically reduce the energy burden of data centers. Evaporative cooling has been successfully utilized in many data center applications to maintain (and even improve) space condition requirements while at the same time significantly shrinking the energy footprint of the building. This seminar provides case studies of the use of evaporative technologies to enhance sustainable data center design and operation.

1. Dissipation of Data Center Heat Through Polymer Tube Indirect Evaporative Coolers
Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV; Keith Dunnavant, P.E., Member, Munters/Des Champs Laboratories, Buena Vista, VA
2. Grey Water Savings in Green Data Centers
Jeff Sloan, P.E., Member, McKinstry Co., Seattle, WA
3. Data Center Cooling: Fail Safe and Sustainable
Thomas Weaver, P.E., Member, Conservation Mechanical Systems, Sebastopol, CA
Seminar 36 (Basic)

Noise and Vibration Effects on Staff Performance and Patient Welfare in Healthcare Facilities

Track: Indoor Environmental Topics

Water Tower Parlor (6)

Monday, 1/26, 2:15 p.m.–3:45 p.m.

Sponsor: 2.1 Physiology and Human Environment, 9.6 Healthcare Facilities, 2.6 Sound and Vibration Control

Chair: Lily M. Wang, Ph.D., P.E., Member, University of Nebraska–Lincoln, Omaha, NE

Noise and vibration in healthcare facilities, often from building mechanical systems, can have a detrimental effect on the performance of medical staff and patient well-being. This session presents current research quantifying this impact, as well as design guidelines and case studies that highlight methods for minimizing such effects.

1. Characterizing the Hospital Acoustic Environment and Occupant Response
   Erica E. Ryherd, Ph.D., Member, Georgia Institute of Technology, Atlanta, GA

2. Minimizing Noise in Healthcare HVAC Design
   Michael P. Sheerin, P.E., Member, TLC Engineering for Architecture, Orlando, FL

3. Mechanical and Footfall Vibration Impact to Healthcare Facilities: Criteria and Design Strategies based on Research and Case Studies
   Michael Gendreau, Member; Hal Amick, Ph.D., P.E., Colin Gordon and Associates, Brisbane, CA

4. Case-Study on the Noise and Vibration Design for a Pediatric Research Facility
   Jack B. Evans, PE, Member, JEAcoustics, Austin, TX

MONDAY, 1/26,
2:15 p.m.–3:15 p.m.

Forum 13 (Intermediate)

How Are You Using the ASHRAE Service Life and Maintenance Cost Database and How Can We Improve It?

Track: Systems and Equipment

Salon 2

Monday, 1/26, 3 p.m.–5 p.m.

Sponsor: 7.8 Owning and Operating Costs

Chair: Matthew E. Mullen, PE, Member, EMCOR Services New England Mechanical, Coventry, CT

This forum helps ASHRAE determine the current level of interest and utilization of the ASHRAE Service Life and Maintenance Cost Database, what kind of information are users finding the most helpful and what additional information or data they would like to see. The on-line database will be actively displayed during the forum so attendees comment as they see it.

MONDAY, 1/26,
3 p.m.–5 p.m.

See it at McCormick Place

Public Session

Sustainability in the Urban Environment

Track: Sustainability

S104 (McCormick Place)

Sponsor: Conferences and Expositions Committee

Chair: Dennis J. Wessel, P.E., Fellow ASHRAE, Karpinski Engineering, Cleveland, OH

Open session—no badge required

This Public Session presents work being done in both northern and southern cities. The City of Chicago has a sustainability program in place and has made significant advances in getting residents to work toward that common goal. Chicago’s program, its implementation and its successes are addressed in the first presentation. The electric utility company in the city of Austin, Texas is working with local government and industry in the development of a sustainability program. The second speaker discusses the advancements made in Austin toward their green goal. The third speaker discusses sustainable urbanism as addressed in his book. In addition, an update is presented on the proposed LEED ND (Neighborhood Developments) certification program, which is working toward making entire communities sustainable.

1. City of Chicago’s Sustainability Program
   Suzanne Malec-McKenna, City of Chicago, Chicago, IL

2. Think Global, Act Local: The Austin Texas Story
   Maureen Scanlon, P.E., Austin Energy Green Building, Austin, TX

3. Development of LEED-ND
   Douglas Farr, Farr Associates, Chicago, IL
TUESDAY, 1/27, 8 a.m.–9:30 a.m.

Meet the authors: 33 papers presented in the one-on-one, Q&A discussion poster session

Modeling sessions on airborne contaminant dispersion, CFD

More data center sessions on airflow management for rack enclosures

ERV tips for complying with 90.1, LEED and 189.1P

Featured session at 3:15 p.m. – “Emerging Public Policy Issues for Climate Change and Buildings”

Tuesday Sessions held at the Palmer House Hilton

Seminar 37 (Intermediate)

Double-Skin Building Facades: What Energy Savings Do They Offer and How Do You Design for Them?, Part 1

Track: High Performance Systems

Monroe (6)

Sponsor: ASHRAE Associate Society Alliance, 4.1 Load Calculation Data and Procedures

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

Buildings with double skin facades have increased during last decade all around the world. Reasons are opportunities to improve environment, good sound insulation, new aesthetics impression and better energy efficiency of a building. Such buildings have a glass envelope above the basic one, different types of construction concerning outer façade, various lengths of the gap between two facades; that result in different solutions of air circulation through among two facades, different effects concerning heat losses in cold periods and cooling loads in hot regions, as well as in humid climates. The seminar gives an overview of such buildings, examples of different climatic regions, the procedure of calculating heating and cooling loads, optimization and simulation of such envelopes and even an example of double skin roof.

1. Double Skin Facades: Types of Constructions, Air Circulation Between Two Facades in Winter and Summer, Estimation of Heating Losses and Cooling Loads

Branislav Todorovic, Ph.D., Fellow ASHRAE, University Belgrade, Belgrade, Serbia

2. Double Skin Facades Integration and Optimization in North European Climates

Harris Poirazis, Ph.D., Member, ARUP, London, United Kingdom

3. Photovoltaic Double Facades Dynamic Performance

Marija Todorovic, Ph.D., Member, University of Belgrade, Belgrade, Serbia

Tuesday, 1/27, 8 a.m.–9:30 a.m.

Seminar 38 (Intermediate)

Can Air Cleaning Reduce Ventilation Rate Required for Acceptable IAQ?

Track: Indoor Environmental Topics

Empire (L)

Sponsor: 4.3 Ventilation Requirements and Infiltration

Chair: Jensen Zhang, Ph.D., Member, Syracuse University, Syracuse, NY

Air cleaning technologies can be used to remove pollutants from outdoor and indoor sources, and hence have the potential to reduce the ventilation rate required and save energy without lowering indoor air quality. However, use of air cleaning methods to reduce ventilation rate in practice is challenging.
because of the multiple pollutants present in indoor air, insufficient performance data on air cleaners, and undesirable by-products/side effects from the use of air cleaners. This seminar summarizes latest research results on performance of existing air cleaning technologies and products, identifies issues that need to be addressed in air cleaning and ventilation system design and assesses the potential of air cleaning in reducing ventilation rate and saving energy while simultaneously improving IAQ.

1. Introduction: The Role of Air Cleaning in IAQ Control
Jensen S. Zhang, Ph.D., Member, Syracuse University, Syracuse, NY

2. Performance of Existing Portable and Residential In-Duct Air Cleaners: Capability and Problems
Wenhao Chen, Associate Member, Syracuse University, Syracuse, NY

3. Ozone Emission/Particle Formation from Portable Air Cleaners
Jeffrey Siegel, Ph.D., Member, University of Texas at Austin, Austin, TX

4. Sensory Pollution from Different Ventilation Filters
Gabriel Beko, Syracuse University, Syracuse, NY

5. Indoor Air Cleaning in China: Demand, Problem and Standard
Yinping Zhang, Tsinghua University, Beijing, China

Tuesday, 1/27, 8 a.m.–9:30 a.m.

Seminar 39 (Intermediate)

For Sustainable and Safe Tunnel Environment: Fire Prevention, Detection and Engineering Analysis

Track: Sustainability
Water Tower Parlor (6)
Sponsor: 5.9 Enclosed Vehicular Facilities, 5.6 Control of Fire and Smoke
Chair: Paul C. Miclea, PE, Member, Earth Tech AECOM, Walnut Creek, CA

This seminar addresses the issues related to tunnel safety and identifies means and practices to ensure sustainable environment. An overview of reliable prevention and detection systems, capable to provide early warnings of fire incidents and help ensure timely activation of emergency ventilation systems, is presented. Results are presented from research conducted by the National Research Council of Canada and the Fire Protection Research Foundation, which investigated current fire detection technologies for road tunnel applications. Information on tunnel safety in Europe is presented.

1. The International Road Tunnel Fire Detection Project Phase II: Lab Fire Testing Program
Gary Lougheed, P.Eng., Member, National Research Council Canada, Ottawa, ON, Canada

2. The International Road Tunnel Fire Detection Project Phase II: Field Fire Testing Program
Ahmed Kashef, P.Eng., Member, National Research Council Canada, Ottawa, ON, Canada

3. The International Road Tunnel Fire Detection Project Phase II: CFD Numerical Simulations
George Hadjisophocleous, P.Eng., Member, Carleton University, Ottawa, ON, Canada

4. Road Tunnel Safety and Security in Europe
Paul C. Miclea, P.E., Member, Earth Tech AECOM, Walnut Creek, CA; Jurij Modic, Dr.Eng., Member, University of Ljubljana, Ljubljana, Slovenia

Tuesday, 1/27, 8 a.m.–9:30 a.m.

Seminar 40 (Intermediate)

Innovations in Airflow Management within Rack Enclosures, Part 1

Track: Applications
Salons 8/9 (3)
Sponsor: 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment
Chair: Kishor K. Khankari, Member, Syska Hennessy, Ann Arbor, MI

While avoiding any mixing of hot air with the incoming cold air, effective management and removal of hot air from the rack enclosures is the key factor in maintaining server inlet air temperatures within ASHRAE guidelines. This seminar provides an overview of issues and recent design innovations for airflow management within rack enclosures.

1. Airflow Management within Rack Enclosures: An Overview
Kishor Khankari, Ph.D., Member, Syska Hennessy Group, Ann Arbor, MI

2. Cable Management Considerations for Equipment Using Side-to-Side Airflow
James Fleming, Member, and Rhonda Johnson, Member, Panduit Corp., Tinley Park, IL

3. Breakthrough in Return Air Containment
Ian Seaton, Chatsworth Products, Inc., Georgetown, TX
Seminar 41 (Advanced)

Inverse Modeling of Airborne Contaminant Dispersion in Enclosed Environments, Part 1

Track: Indoor Environmental Topics
Crystal (3)
Sponsor: 4.10 Indoor Environmental Modeling
Chair: Qingyan Chen, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN

In many cases, the location of an airborne contaminant source and its strength in an enclosed environment may be unknown, such as infectious disease viruses and intentional release of chemical/biological agents. However, the information is very important for providing a healthy and safe environment for its occupants. Different numerical models are presented in this seminar that can be used to identify the contaminant location and strength.

1. System to Pinpoint Airline Passengers Who Contaminate Cabins
Qingyan Chen, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN

2. Identification of Source from Limited Sensor Response by Means of Inversion of Response Factor Convolution
Shinsuke Kato, Dr.Eng., Fellow ASHRAE; K. Hiyama, M.D., Y. Ishida, Dr.Eng, University of Tokyo, Tokyo, Japan

3. Practical Application of Whole Field Measuring Methods in Studying Air Distribution in Rooms
Mats Sandberg, University of Gävle, Gävle, Sweden; Tomohiro Kobayashj, Osaka University, Osaka, Japan; Elisabet Linden, Svante Lindstrom, University of Gävle, Gävle, Sweden

Seminar 42 (Intermediate)

The Tables Re-loaded: Rollout of the New Climatic Information in the 2009 Fundamentals

Track: Fundamentals
Wabash (3)
Sponsor: 4.2 Climatic Information
Chair: Drury B. Crawley, Member, U.S. Department of Energy, Washington, DC

In updating the chapter on climatic information for the 2005 Handbook—Fundamentals, TC 4.2 took a major step forward by including over 4,400 weather locations worldwide. For the 2009 Fundamentals, Chapter 28 has been revised again. The tables have been re-loaded (updated and expanded) with new elements and now contain over 5500 locations worldwide. Climate-related material has been moved from other Handbook chapters into Chapter 28. New solar models replace the older solar models that have been in the Fundamentals for many years. The new models even support calculations outside North America. Finally, there are new and improved design day profiles. This session provides an overview of all the new and improved data and calculations soon available to the membership—TC 4.2’s best chapter yet!

1. What’s New in Climatic Information (Chapter 28)?
Robert Morris, Member, Environment Canada, Downsview, ON, Canada

2. New Solar Models for Design Calculations
Didier Thevenard, Member, Numerical Logics, Waterloo, ON, Canada

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

Seminar 42A (Intermediate)

Water To Water Heat Pump System Design, Standards and Applications in Urban Settings

Track: Applications
Adams (6)
Sponsor: 9.4 Applied Heat Pump/Heat Recovery Systems
Chair: Jeff Smith, Member, Georgia Power Co., McDonough, GA

With sustainability now in the forefront of HVAC design, this seminar discusses the benefits water to water heat pumps can have when applied in urban settings. The wide variety of commercial, residential and industrial applications with this technology can greatly improve the sustainability of buildings even in predominantly urban areas.

Robert Brown, Member, Water Furnace International, Fort Wayne, IN

2. A Successful Geothermal Water to Water Application at a New Jersey Facility
JB Singh, Fellow ASHRAE, J&P Consulting Engineers, Linwood, NJ

3. Industrial Economic Applications of Water to Water Heat Pumps
Frank Pucciano, Member, Global Energy Systems, Lilburn, GA
Tuesday, 1/27, 9:45 a.m.–10:45 a.m.

Transactions Session 11 (Intermediate)

CFD Modeling for Analysis of Smoke Control Systems

Track: Fundamentals
Crystal (3)
Sponsor: 5.6 Control of Fire and Smoke, 5.9 Enclosed Vehicular Facilities
Chair: Ray Sinclair, Ph.D., Member, RWDI, Guelph, ON, Canada

This session discusses the verification and use of CFD models for smoke control applications. The verification of CFD results using the results from two compartment fire experiments are presented. Also, the impact of various parameters on CFD predictions for atrium smoke management is discussed. In addition, CFD results are compared with estimates from algebraic equations.

1. Verification of CFD Modeling for Smoke Control Using Two Compartment Fire Experiments (CH-09-027)
Kai Kang, P.E., Member, Jacobs, New York, NY

2. Impact of Various Parameters on the CFD Predictions of Atrium Smoke Management Systems (CH-09-028)
Yoon J. Ko, Ph.D., Carleton University, Ottawa, ON, Canada

Tuesday, 1/27, 9:45 a.m.–10:45 a.m.

Transactions Session 12 (Advanced)


Track: Systems and Equipment
Adams (6)
Sponsor: 7.5 Smart Building Systems, 1.10 Cogeneration Systems
Chair: Rich Hackner, P.E., Member, GDS Associates, Madison, WI

This session details the results of the recently completed ASHRAE Research Project 1340, Intelligent Control of Combined Heat and Power (CHP) Systems. The main objective of this research effort was to identify guidelines for more cost-effective operation and control of CHP plants in commercial building applications. The research project involved two phases. The first phase involved the generation of necessary data for certain characteristic building types with rationally designed and sized BCHP equipment. The second phase involved performing parametric simulations and studying the magnitude and variability of the cost penalty ratio (CPR and defined as the ratio of the near-optimal to the optimal solutions) values across the multiple building, equipment and utility rate scenarios selected and distilling the results.

1. Cost Penalties of Near-Optimal Scheduling Control of BCHP Systems, Part 1: Selection of Case Study Scenarios and Data Generation (RP-1340) (CH-09-029)
Itzhak Maor, Ph.D., Member, PWI Energy Inc., Cherry Hill, NJ; T Agami Reddy, Member, Drexel University, Philadelphia, PA

2. Cost Penalties of Near-Optimal Scheduling Control of BCHP Systems, Part 2: Modeling, Optimization and Analysis Results (RP-1340) (CH-09-030)
T Agami Reddy, Member, Drexel University, Philadelphia, PA; Itzhak Maor, Ph.D., Member, PWI Energy Inc, Cherry Hill, NJ

Tuesday, 1/27, 9:45 a.m.–10:45 a.m.

Seminar 43 (Intermediate)

Enhancing Your Chapters for ASHRAE Handbook’s CD+

Track: Fundamentals
Empire (L)
Sponsor: Handbook Committee
Chair: Daniel J. Dettmers, Member, University of Wisconsin–Madison, Madison, WI

While the print version of the four ASHRAE Handbooks is regarded as the first source for information on the HVAC and Refrigeration industries, many ASHRAE members are looking for more. To meet that need, ASHRAE rolled out the CD+. The CD+ incorporates all the information found in the print handbook, but also allows the cognizant technical committees to expand the material without limitations on page length or static print. In this seminar, participants will see examples of checklists, animations, video, and software tools that can be added to their handbook chapters.

1. An Introduction to the ASHRAE CD+
Mark Owen, Member, ASHRAE, Atlanta, GA

2. Example of an Enhanced Chapter
Jeff Haberl, Texas A & M University, College Station, TX

3. Ideas for Enhancement and Tools to Achieve It
Daniel J. Dettmers, Member, University of Wisconsin–Madison, Madison, WI
Seminar 44 (Intermediate)

**BIM and Building Performance Analysis**

**Track:** Sustainability  
**Wabash (3)**  
**Sponsor:** 1.5 Computer Applications

**Chair:** Krishnan Gowri, Member, Pacific Northwest National Laboratory, Richland, WA

This seminar addresses what BIM is and how it can be used for building energy analysis and code compliance for LEED, Title 24 or ASHRAE 90.1.

1. **Using BIM for LEED Certification**  
Stephen Roth, P.E., Member, Autodesk, Inc., San Rafael, CA

2. **Using BIM to Achieve a High LEED Rating**  
Annette Stumpf, ERDC-CERL, Champaign, IL

Seminar 45 (Basic)

**Variable Speed Pump Applications for Energy Savings in Buildings**

**Track:** Systems and Equipment  
**Monroe (6)**  
**Sponsor:** 6.1 Hydronic and Steam Equipment and Systems

**Chair:** Greg Towsley, Member, Grundfos Pumps Corp., Olathe, KS

Pumps and pumping systems are many times forgotten as a source for energy savings in a building’s operation, even though they are a primary consumer of the world’s energy production. Improvements in a new pump system design or a system upgrade can include more efficient pumps, a better understanding of the system operation and variable speed pumping. By presenting applications of variable speed pumps and conveying the energy savings that may be obtained, this seminar seeks to aid engineers, architects, and contractors in considering variable speed pumping systems to reduce energy consumption in buildings.

1. **Using Variable Speed Pumping to Improve Performance of an Existing Domestic Water Booster System in a Chicago Building**  
Brendan Bates, Mike Ponx, Metropolitan Industries, Inc., Romeoville, IL

2. **Energy Savings by Using Adaptive High Efficiency Variable Speed Pumps**  
Niels Bidstrup, Ph.D., Member, Grundfos Management A/S, Bjerringbro, Denmark

3. **Variable Speed Pumping in a Boiler Feed Application**  
Chad Fletcher, Member, Hurst Boiler and Welding Co., Inc., Coolidge, GA

Forum 14 (Intermediate)

**Is ASHRAE Prepared to Adapt to Climate Change?**

**Track:** Sustainability  
**Salons 8/9 (3)**  
**Sponsor:** 2.5 Global Climate Change

**Chair:** Cynthia Gage, Ph.D., Fellow ASHRAE, U.S. Environmental Protection Agency, Durham, NC

ASHRAE’s design guides and standards have been developed and applied based on historical statistics of climate and weather. Climate zones, weather bin data, design dry bulb and wet bulb temperatures, balance points, and measurements of temperature-dependent coefficients such as U-factors are just some of the data which have been built from this historical record. Now ASHRAE has set sustainability goals of moving to 30% more efficient buildings and eventually to net-zero energy buildings. If designed based on present data, can buildings and equipment perform as desired through their lifetime? Will test rating procedures need to be adjusted? What should ASHRAE do to ensure that its methodologies and guidance provide robust approaches? How should ASHRAE prepare for a climate which has already changed from historical yet is still in flux?

Forum 15 (Basic)

**What Should Be Included in a Proposed New Justice Facilities Design Guide?**

**Track:** Applications  
**Water Tower Parlor (6)**  
**Sponsor:** TG9 Justice Facilities (JF), 9.8 Large Building Air-Conditioning Applications

**Chair:** E. D. Fitts, P.E., Member, Fitts HVAC Consulting, LLC, Sunrise Beach, MO

TG9, JF on Justice Facilities is proposing to develop a new design guide and would like to discuss the contents of such a guide in order to provide a source of current information and state of the art to the design community. Input from designers of justice facilities, local authorities, government entities and international aspects are especially desired.
TUESDAY, 1/27,
11 a.m.–12:30 p.m.

Transactions Session 13 (Advanced)

Phase 2 of ASHRAE RP-1292 Comparison of the Total Energy Consumption of Series vs. Parallel Fan Powered VAV Terminal Units

Track: Systems and Equipment
Wabash (3)

This transactions session reports on the results of ASHRAE RP-1292. The papers recap the research as well as cover a final overview of the results.

1. Modeling the Performance of Single-Duct VAV Systems with Fan Powered Terminal Units (RP-1292) (CH-09-031)
   Dennis L. O’Neal, Ph.D., Member; John A. Bryant, Ph.D., Member; Michael Davis, Associate Member, Texas A&M University, College Station, TX

2. Experimental Verification of a Three Zone VAV System Model Operating with Fan Powered Terminal Units (RP-1292) (CH-09-032)
   John A. Bryant, Ph.D., P.E., Member; Michael A. Davis, P.E., Member; Dennis L. O’Neal, Ph.D., P.E., Member, Texas A&M University, College Station, TX

3. Reflections on ARI/ASHRAE Research Project 1292-RP: Comparison of the Total Energy Consumption of Series Versus Parallel Fan Powered Terminal Units (RP-1292) (CH-09-033)
   Eugene W. Faris, Member, Nailor Industries, Houston, TX

CO2 Systems, Components and Applications

Track: Refrigeration
Salons 8/9 (3)

Significant progress has been made in the design, field implementation, and monitoring for performance and energy efficiency of refrigeration, air-conditioning and heat-pump systems using carbon dioxide as the refrigerant and/or secondary coolant. This seminar provides information on the state-of-the-art of CO2 systems and components in the entire range of applications: unitary, commercial, and industrial refrigeration and air-conditioning in both subcritical and transcritical operational conditions. The presentations reach beyond the general information on CO2 and its vapor-compression cycles and leads to a significant impetus to advance CO2 systems.

1. Design Considerations for CO2 Vapor-Compression Systems
   Denis Clodic, Ph.D., Member, Ecole des Mines de Paris, Cedex, France

2. CO2 Compressors for Commercial and Industrial Refrigeration Systems: Challenges, State of the Art and Future Perspectives
   Giacomo Pisano, Dr.Eng., Affiliate, Officine Mario Dorin, Compioibbi, Firenze, Italy

3. CO2 Compressors for Commercial and Industrial Applications
   Hermann Renz, P.Eng., Member, Bitzer Kuehlmachinesnbau, Sindelfingen, Germany

4. Application Study of CO2 Transcritical Refrigeration Cycle with Hermetic Rolling Piston Type 2 Stage Compressor
   Masayuki Soma, Ph.D., P.Eng., Sanyo Electric, Wood Dale, IL

Benchmarking Hygrothermal Tools

Track: Applications
Crystal (3)

The hygrothermal performance of building envelope system is dictated by the response of the system to combined heat, air and moisture fluctuations produced by exterior and interior conditions that exist on either side of the envelope. Recent research in the field of assessment of hygrothermal response has focused on either laboratory experimentation or modeling, but less work has been reported in which both aspects are combined. Indeed, it is generally acknowledged that assessing the hygrothermal performance of building envelope systems is both expensive and time consuming. Such type of studies can potentially offer useful information regarding the benchmarking of models and related methods to assess hygrothermal performance of wall assemblies. This seminar is focused on the different ways to benchmark the hygrothermal models i.e. inter-model comparison, analytical and empirical verification.
1. Selecting Weather Data for Hygrothermal Analyses
Mikael Salonvaara, P.Eng., Member, Huber Engineered Woods LLC, Commerce, GA

2. Variation and Validation: Establishing Confidence in Hygrothermal Tools
Steve Cornick, P.Eng., Member; Wahid Maref, Ph.D., P.Eng., Member; Fitsum Tariku, Ph.D., P.Eng., National Research Council Canada, Ottawa, ON, Canada

Achilles Karagiozis, Ph.D., P.Eng., Member, Oak Ridge National Laboratory, Oak Ridge, TN

Tuesday, 1/27, 11 a.m.–12:30 p.m.

Seminar 48 (Advanced)
Track: High Performance Systems
Monroe (6)
Sponsor: ASHRAE Associate Society Alliance, 4.1 Load Calculation Data and Procedures
Chair: Kent Peterson, P.E., Presidential Member Fellow ASHRAE, P2S Engineering, Inc., Cypress, CA

Buildings with double skin facades have increased during last decade all around the world. Reasons are opportunities to improve environment, good sound insulation, new aesthetics impression and better energy efficiency of a building. Such buildings have a glass envelope above the basic one, different types of construction concerning outer facade, various lengths of the gap between two facades; that result in different solutions of air circulation through among two facades, different effects concerning heat losses in cold periods and cooling loads in hot regions, as well as in humid climates. The seminar gives an overview of such buildings, examples of different climatic regions, the procedure of calculating heating and cooling loads, optimization and simulation of such envelopes and even an example of double skin roof.

1. Naturally Ventilated Double-Skin Facades: Performance Prediction and Validation
Per Heiselberg, Aalborg University, Aalborg, Denmark

2. Optimization of Passive Cooling by Natural Convection in Double-Skin Roofs
P. H. Biwole, INSA-Lyon, Cedex, France

3. A Zone Approach for Modeling Ventilated Double-Skin Facade
Jiru Teshome, Purdue University, Lafayette, IN

Tuesday, 1/27, 11 a.m.–12:30 p.m.

Seminar 49 (Intermediate)
Innovations in Airflow Management within Rack Enclosures, Part 2
Track: Applications
Water Tower Parlor (6)
Sponsor: 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment
Chair: Kishor K. Khankari, Ph.D., Member, Syska Hennessy, Ann Arbor, MI

While avoiding any mixing of hot air with the incoming cold air, effective management and removal of hot air from the rack enclosures is the key factor in maintaining server inlet air temperatures within ASHRAE guidelines. This seminar provides an overview of issues and recent design innovations for airflow management within rack enclosures.

1. Rack Enclosures Role in Isolating the Hot and Cold Aisle in the Datacenter
Joe Kramer, APC by Schneider Electric, O'Fallon, MT

2. Enhancing Airflow Efficiency at the Cabinet Level via Deployment of Variable Speed Fans with Dynamic Controller
John Consoli, AFCO Systems Inc, Farmingdale, NY

3. Rack Air Dynamics Trends: Past and Present
Mark Germagian, Member, Opengate Data Systems, Hubbardston, MA

Tuesday, 1/27, 11 a.m.–12:30 p.m.

Seminar 50 (Advanced)
Inverse Modeling of Airborne Contaminant Dispersion in Enclosed Environments, Part 2
Track: Indoor Environmental Topics
Adams (6)
Sponsor: 4.10 Indoor Environmental Modeling
Chair: Qingyan Chen, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN

In many cases, the location of an airborne contaminant source and its strength in an enclosed environment may be unknown, such as infectious disease viruses and intentional release of chemical/biological agents. However, the information is very important for providing a healthy and safe environment for its occupants. Different numerical models are presented in this seminar that can be used to identify the contaminant location and strength.

1. Identification of Indoor Airborne Contaminant Sources with Probability-Based Inverse Modeling Methods
John Zhai, Ph.D., Member; Xiang Liu, Student Member, University of Colorado at Boulder, Boulder, CO

2. Rapid Contaminant Mass and Source Location Estimation using Limited Sample Data from CFD Results

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Seminar 51 (Intermediate)
Natural Ventilation for Sustainable Healthcare Facilities
Track: High Performance Systems
Empire (L)
Sponsor: 9.6 Healthcare Facilities
Chair: Roger Lautz, P.E., Member, Henneman Engineering, Brookfield, WI

Learn what areas in healthcare might be served by natural ventilation to promote sustainable urban environments: what works, what does not, and how to properly apply it.

1. Infection Control Challenges
Sidney Parsons, Ph.D., P.E., Member, CSIR Built Environment, Pretoria, South Africa

2. Applicability to U.S.

3. UK Hospitals
Frank A. Mills, P.E., Member, Environmental Design Consultants, Chorley, Lancashire, United Kingdom

4. Level III NICU after 5 Years
Richard Moeller, P.E., Member, CDI Engineers, Lynnwood, WA

Tuesday, 1/27, 11 a.m.–12:30 p.m.

Poster Session
Red Lacquer (4)

A Comparative Study Between a Constant-Speed Air-Conditioner and a Variable-Speed Air-Conditioner (CH-09-034)
Ing Youn Chen, Ph.D., Associate Member; Yi Min Chen, National Yunlin University of Science and Technology, Touliu, Yunlin, Taiwan; Yi-Juei Chang; Chun Shi Wei; Chi Chuan Wang, Ph.D., Fellow ASHRAE, Industrial Technology Research Institute, Hsinchu, Taiwan

The present study compares the performance between a constant-speed air-conditioner and a variable-speed air-conditioner subject to identical operation conditions. Influences of added heat load, ambient temperature, and setting point temperature on the system performances had been examined. The results show that the average consumed power is increased with the increase of heat load and with the decrease of Tset. Also, the variable-speed AC consumes less average power than that of the constant-speed AC under the same heat load and Tset. For the same initial room temperature, the constant-speed AC can reach setting point earlier.

Advancing Automated Demand Response Technology (CH-09-035)
Steven T. Bushby, Member; David G. Holmberg, Member, NIST Building & Fire Research Lab, Gaithersburg, MD

For several years electric utilities have implemented a wide variety of programs to curtail load in times of stress on the electricity distribution grid or on generating capacity. Although these programs have shared a common goal of reducing peak electricity demand, there have been many differences in the details of the programs and the methods for communicating with customers. This paper describes how recent legislation, standards development efforts, and a demand response demonstration project offer the possibility of breakthrough changes in the way that buildings and utilities interact that could be applied broadly throughout the country.

BACnet Object Modeling by UML on High-Level Functionality of VRF Air-Conditioning Systems (CH-09-36)
Chuzo Ninagawa, Ph.D.; Tomotaka Sato, Mitsubishi Heavy Industries, Ltd., Nagoya, Japan

This paper provides a new implementation model of the BACnet objects on high-level functionality for variable refrigerant flow (VRF) air-conditioning systems for commercial buildings. First, the paper discusses a model of the “air-conditioner cell” that consists of a group of BACnet standard type objects using the unified modeling language (UML). In addition, this paper provides a new concept of a “virtual watt meter” using the BACnet accumulator object type for power consumption allocation to each tenant of the building. Examples of computer simulation and field testing show the effectiveness of our approach to expedite communication access and to provide more accurate allocation of power consumption for VRF air-conditioning systems.

Calibration of a Building Energy Model Using Measured Data (CH-09-037)
Danielle Monfet, Student Member; Radu Zmeureanu, Ph.D., P.Eng., Member, Concordia University, Montréal, QC, Canada; Roland Charnieux, P.Eng., Fellow ASHRAE, Eiffel Consulting, Montréal, QC, Canada
This paper presents the calibration of a building energy model of a university building, developed using the EnergyPlus simulation program, by comparing data monitored over the spring season, from March 20 to June 20 2006. The building under study is the new Concordia Sciences building, located in Montreal, Qc, which mainly consists of research and academic labs. This paper presents the approach used to calibrate the model, the results of calibration as well as problems encountered throughout the process from the user’s perspective. The predictions of the supply and return air temperatures, the supply airflow rate, and of the whole building cooling loads, made by the EnergyPlus program over the spring season, are in agreement with monitored data.

**Characterization of Cooking Effluent from Seven Commercial Kitchen Appliances and Representative Food Products (RP-1375) (CH-09-038)**

Thomas H. Kuehn, Ph.D., Member; Bernard A. Olson, Ph.D.; James W. Ramsey, Ph.D., Member; Joshua M. Rocklage, Student Member, University of Minnesota, Minneapolis, MN

The main objective of this study was to characterize the grease emissions from seven common commercial kitchen cooking appliances and associated food products. Emission measurements were made in the center of the plume above each appliance at the lower entrance to an eight foot canopy exhaust hood and in the center of the horizontal exhaust duct approximately six feet downstream from the hood collar. No filters were used in the hood for these measurements. Particulate mass concentration data were obtained from 0.5 to 15m with personal cascade impactors and number concentration data were obtained from 20 nm to 0.8m with scanning mobility particle sizers. Grease vapor results were obtained using an EPA method five stack gas sampler.

**Comparisons of HVAC Simulations Between EnergyPlus and DOE-2.2 for Data Centers (CH-09-039)**

Tianzhen Hong, Ph.D., P.E., Member; Dale Sartor, P.E.; Paul Mathew, Ph.D.; Mehry Yazdian, Lawrence Berkeley National Laboratory, Berkeley, CA

This paper compares HVAC simulations between EnergyPlus and DOE-2.2 for data centers. The HVAC systems studied in the paper are packaged direct expansion air-cooled single zone systems with and without air economizer. Four climate zones are chosen for the study--San Francisco, Miami, Chicago, and Phoenix. EnergyPlus version 2.1 and DOE-2.2 version 45 are used in the annual energy simulations. The annual cooling electric consumption calculated by EnergyPlus and DOE-2.2 are reasonably matched within a range of -0.4% to 8.6%. The paper also discusses sources of differences between EnergyPlus and DOE-2.2 runs including cooling coil algorithm, performance curves, and important energy model inputs.

**Data Processing and Data Mining on Energy Consumption Database of Commercial Buildings in Shanghai (CH-09-040)**

Yiqun Pan, Ph.D., and Zhizhong Huang, Tongji University, Shanghai, China; Xiaowei Zheng, Shanghai Real Estate Science Research Institute, Shanghai, China

This paper adopts data processing methods and data mining technology to develop a building energy consumption model, based on an energy consumption database of commercial buildings that includes 95 commercial buildings in Shanghai. The software SAS is used as the tool for data processing and data mining. An optimum regression model of building energy consumption is made for each missing data element. Through comparing the three optimum regression models and their prediction results of building energy consumption, it is found that the regression imputation method was the best method to handle missing data.

**Effectiveness and Performance of a Counter Flow Liquid Desiccant Regeneration Tower in a Hot-Humid Climate (CH-09-041)**

Esam Elsarrag, Ph.D., Member, Hoare Lea Consulting Engineers, Poole Dorset, United Kingdom; Kamal Abdalla, Ph.D., University of Khartoum, Sudan

The regeneration process represents the vital part of the liquid desiccant air conditioning system. In this study, a solar assisted liquid desiccant packed regeneration tower is tested in a hot-humid climate. The regeneration design parameters are classified as controlled parameters, input parameters and output parameters. The regenerator performance is assessed using previously published results. A new regenerator effectiveness definition based on the desiccant properties is deduced and assessed experimentally. An empirical effectiveness correlation and a quick model are presented to predict the outlet desiccant concentration and temperature. The new effectiveness and the humidity effectiveness are used to optimize the design parameters.

**Electrochemical Cooling Water Treatment: A New Strategy for Control of Hardness, Scale, Sludge and Reducing Water Usage (CH-09-042)**

Henry A. Becker, Member; Jon J. Cohen, Member, H-O-H Water Technology, Palatine, IL; Alan D. Zdunek, Ph.D., Illinois Institute of Technology, Chicago, IL

Fouling due to calcium salts present in hard water has proven historically troublesome in metal plating, chlor-alkali production, and other electrolytic operations. It is perhaps ironic, this classical nuisance includes mechanisms for effective control of troublesome deposition throughout large, real-world recirculating water systems; effectively establishing a new water treatment strategy of environmental and economic benefit. An electrolytic process can be employed for evaporative cooling systems of all types to generate in-situ chemistry and physical activity totally controlling hard-water deposits and minimizing both corrosion and biofouling. This is accomplished without classical chemical treatment or water conditioning while also allowing substantial reduction in cooling system bleedoff.

**Energy Analysis of 1 Ton Generator- Absorber- Exchange Absorption Compression (GAXAC) Cooler (CH-09-043)**

Ayyappan Ramesh Kumar, Thiagarajar College of Engineering, Madurai, Tamilnadu, India; M. Udayakumar, National Institute of Technology, Trichy, Tamilnadu, India; R. Saravanan, Anna University, Chennai, Tamilnadu, India

Energy analysis of GAX absorption-compression system using ammonia–water as working fluid with a capacity of 3.54 kW (1 TR) for space conditioning at optimum de-gasing range 0.458 kg of ammonia per kg of strong solution is presented. In the GAX absorption-compression cycle COP value of 1.33 for cooling and 2.33 for heating was obtained, with an internal energy exchange of 4.819 kW. Energy analysis also was carried out for the GAX conventional cycle and a COP value of 0.95 for cooling and 1.95 for heating was calculated, with an internal energy exchange of 4.658 kW for the same capacity. The results from the present study and the published results in literature are compared and a reasonable agreement is observed.
**Energy Conservation at the Oak Park Public Works Center (CH-09-044)**

Jonathan M. Mesek, P.E., Member, Holabird & Root, Chicago, IL; Douglas Howery, Jr, Member, Johnson Marcraft Inc, Maryland Heights, MO

This paper provides an overview of the methods used to conserve energy at the Oak Park Public Works Center in Oak Park, IL, which led to an energy savings of 32.7% beyond ASHRAE 90.1-1999. The paper discusses the reduction of the air volume provided to the vehicle storage and maintenance garage through the use of contaminant sensors. The paper then discusses heat recovery utilized at the facility and the unique conditions that led to the decision to use a plate and frame air-to-air heat exchanger.

**Energy Efficient, Cost Effective, Passive Solar House (CH-09-045)**

James A. Mathias, Ph.D., P.E., Associate Member, Southern Illinois University–Carbondale, Carbondale, IL; Duane M. Mathias, A Partnership for Better Homes, Rochester, MN

A house was constructed in Carbondale, IL, in the mixed humid climate region, using the best current construction methods with commonly available materials. Good passive solar characteristics were obtained by properly orientating the house to have many south-facing windows with proper overhangs which provided 23% of the energy needed for heating. The house also included 15 cm (6 in) thick insulated walls, insulated concrete forms for foundation walls, insulated rim joist, a ground-source heat pump, Energy-Star windows, clothes washer, refrigerator and compact fluorescent bulbs (CFLs).


B. A. Fleck, Ph.D., P.Eng., University of Alberta, Edmonton, AB, Canada; S. C. Arnold, Lincoln Technology Corp., Edmonton, AB, Canada; M. Y. Ackerman, P.Eng., Member; J. D. Dale, Ph.D., P.E., Member, University of Alberta, Edmonton, AB, Canada; W. E. Klaczek, P.Eng., Member, University of Alberta, Edmonton, AB, Canada

The results of field testing four induced draft residential furnaces at three different altitudes are presented. In this Part 1, the results from the safe operation and derating schemes are presented, while a companion paper, Part 2, contains the results from the steady state efficiency and nitric oxide measurements. The results showed that the furnaces could be fired at all altitudes using the sea level settings of orifice size and manifold pressure without exceeding the 400 ppm carbon monoxide air free (CO-AF) limit in the flue gas. The measured CO and calculated CO-AF concentrations showed the same general trends with increasing altitude for both test fuels.


J. D. Dale, Ph.D., P.Eng., Member; B. A. Fleck, Ph.D., P.Eng., University of Alberta, Edmonton, AB, Canada; S. C. Arnold, Lincoln Technology Corp., Edmonton, AB, Canada; M. Y. Ackerman, P.Eng., Member, University of Alberta, Edmonton, AB, Canada; W. E. Klaczek, P.Eng., Member, University of Alberta, Edmonton, AB, Canada

The results of field testing four induced draft residential furnaces at three different altitudes to evaluate the effect of operating at altitudes above sea level on steady state efficiency and nitric oxide emissions are presented. A companion paper, Part 1, discusses results from studies on safe operation limits and derating schemes at the three test altitudes. The results showed a trend of increasing efficiency with altitude on both fuels (natural gas and propane gas), that propane gas produced the highest efficiencies, and that the highest flue gas NO concentration levels were found at 2,250 ft (685 m), while the lowest occurred at 6,700 ft (2040 m).

**Heat Tolerance Limits for Subjects Exercising in Heavy Clothing (CH-09-048)**

Tai Jang, Ph.D., MACTEC Engineering and Consulting, Inc, San Antonio, TX; Curtis H. Cline, Ph.D.; Kristie Pietarila; Anthony Iyoho, Ph.D.; John Gall; Satish S. Nair, Ph.D., P.E., Member, University of Missouri, Columbia, MO

Two new predictive neural network models are reported to estimate (i) core temperature and heart rate, and (ii) time tolerance limits, for subjects exercising in heavy clothing. Although limited to young fit males, the models account for individual variability, and are applicable over a wide range of warm environments and heavy impermeable clothing levels. The relative importance of relevant subject anthropomorphic parameters, environmental parameters, and work rates on the subject's tolerance time to uncompensable heat stress can also be evaluated via a proposed sensitivity analysis. Among the anthropometric variables, weight was the most relevant to prediction of time tolerance limits.

**How to Simplify Computer Simulated Person (CSP) for Modeling Personal Microenvironment: Comparison and Case Studies (CH-09-049)**

Xudong Yang, Ph.D., Member, Tsinghua University, Beijing, China; Wei Yan, Student Member, University of Illinois, Urbana, IL; Ming Shan, Tsinghua University, Beijing, China

Different computer simulated persons (CSPs) have been developed to represent occupants for indoor airflow simulation using computational fluid dynamics (CFD). Simple CSPs are preferred in order to avoid very fine grids and long computing time. However, how CSPs with different complexity affect the accuracy of CFD simulation is not well studied yet. This paper intends to investigate quantitatively the simulation accuracy due to CSP simplification. A detailed, human-like CSP and three different simplification strategies including an overly simplified rectangular box CSP, a simple CSP using several cuboids to represent different parts of a person, and an improved one in which the total heat of different parts (head, body, arms, legs) matches that of the detailed CSP are proposed.

**Human Thermal Model with Extremities for Asymmetric Environments (CH-09-050)**

Anthony Iyoho, Ph.D., University of Missouri, Columbia, MO; Tai Jang, Ph.D., MACTEC Engineering and Consulting, Inc, San Antonio, TX; Satish Nair, Ph.D., P.E., Member, University of Missouri, Columbia, MO

A new computational model of the human thermal system that accounts for asymmetric environments and includes extremities is reported. The model
incorporates radial and circumferential heat transfer along with arterial and venous countercurrent blood flow. Digits are modeled using arteriovenous anastomoses to provide finer prediction of toe and fingertip temperatures, all of which are important in evaluating extremity discomfort.

Impact of Pressurization on Energy Consumption for Containment Spaces (CH-09-051)
Jin Wen, Ph.D., Associate Member, Drexel University, Philadelphia, PA; Wei Sun, P.E., Member, Engsysco Inc., Ann Arbor, MI; Stephanie Dost, Seattle Pacific University, Seattle, WA

Pressure differential set point and air tightness affect both pressure control and energy consumption for containment spaces such as laboratories and cleanrooms. Due to the lack of engineering means to determine the suitable pressure differential set point during the design stage, such a set point is often intuitively selected.

Improving Control and Operation of a Single Duct VAV System through CCLEP (CH-09-052)
Young-Hun Cho, Student Member; Mingsheng Liu, Ph.D., P.E., Member; Xiufeng Pang, Student Member, University of Nebraska–Lincoln, Omaha, NE; Jinrong Wang, P.E.; Thomas Lewis, Omaha Public Power District, Omaha, NE

This paper discusses the implementation of new innovative technologies in a continuous commissioning leading energy project (CCLEP). Results of a case study show that CCLEP implementation can improve building operations and reduce energy costs. Energy consumption is compared in detail before and after CCLEP. Results show average electricity savings of 26.8% and gas savings of 47.8%.

Improving Efficiency in a Campus Chilled Water System Using Exergy Analysis (CH-09-053)
Justin M. Harrell, Associate Member; James A. Mathias, Ph.D., P.E., Associate Member, Southern Illinois University Carbondale, Carbondale, IL

This paper evaluates the central chilled water system of the Southern Illinois University Carbondale (SIUC) campus using exergy-based cost accounting to quantify the magnitudes and cost impacts of internal losses with the goals of maximizing chiller capacity utilization and minimizing the unit cost of delivered chilled water. Comprised of primary, secondary, and tertiary distribution loops cooled by two 12,300 kW (3,500 RT) steam-turbine-driven centrifugal chillers, the system was modeled as a control volume network using steady-state rate balances for energy, exergy and cost. Results show that while the steam turbine is the largest source of exergy destruction, mixing in the distribution loops is the dominant source of exergy unit cost at low cooling loads, and refrigeration cycle losses dominate costs at high loads.

Investigation of Thermal and Airflow Conditions Near Glazed Facades: Eliminating the Need for Secondary Perimeter Heating Systems (CH-09-054)
Athanassios Tzempelikos, Ph.D., Member; Panagiota Karava, Ph.D., Student Member; Luis Miguel Candanedo, Student Member; Andreas Athienitis, Ph.D., P.E., Member, Concordia University, Montreal, QC, Canada

In cold climates, thermal discomfort usually occurs during the winter close to fenestration. Secondary perimeter heating systems are often employed near windows so as to improve thermal comfort conditions. The paper investigates and compares the performance of three different perimeter heating systems and presents air velocity and temperature gradients near a glazed façade with different perimeter heating configurations. The results showed that the main HVAC system may be used to provide all necessary heating in the perimeter – and ensure thermal comfort- even under extreme winter conditions, provided that appropriate glazing properties and diffuser positioning are selected.

Modeling for Predicting Frost Behavior of a Fin-Tube Heat Exchanger with Thermal Contact Resistance (CH-09-055)
Ehsan Esmailli Darki, M.D., University of Regina, Regina, SK, Canada; Hossein Shokouhmand, Ph.D.; Armin Veshkini, M.D.; Yassaman Sarabi, J.D., University of Tehran, Tehran, Tehran, Iran

In this paper, the performance of a plate finned tube heat exchanger, operating under frosting conditions is investigated. Frost accumulation on the fins and tubes of a heat exchanger, a direct result of combined heat and mass transfer of the moist air flowing across a cold surface, causes heat transfer performance degradation due to the insulating effect of frost layer and the coil blockage as the frost grows. Comparisons were made based on the frost mass accumulation, pressure drop across the coil and energy transfer coefficient and results were found to agree well with reported experimental results. Also the effects of face velocity, relative humidity and working fluid inlet temperature on the air side pressure drop and overall heat transfer coefficient have been investigated.

Modeling Individual Variations in Thermal Stress Response for Humans in Transient Environments (CH-09-056)
Tai Jang, Ph.D., MACTEC Engineering and Consulting, Inc, San Antonio, TX; Anthony Iyoho, Ph.D., University of Missouri, Columbia, MO; Larry Berglund, Ph.D., P.E., Member, USARIEM, Natick, MA; Satish Nair, Ph.D., P.E., Member, University of Missouri, Columbia, MO

The effect of individual differences on thermal stress response for semi-nude supine human subjects in transient environments is modeled using an experimental data set. Two transient climatic parameters and seven individual characteristics are used as inputs to predict three thermal responses using a novel transient computational model. The model is developed using a neural network after ensuring generalization and also checking with results reported in the literature for predictions. It reliably predicts core temperature, skin temperature, and heart rate in transient environmental conditions for individual subjects. A methodology is then proposed to identify the relative importance of the individual parameters and of environmental conditions on thermal stress using a sensitivity analysis.

Optimization of Cooling-Dominated Hybrid Ground-Coupled Heat Pump Systems (RP-1384) (CH-09-057)
Scott Hackel, Member; Gregory Nellis, Ph.D., Member; Sanford Klein, Ph.D., Member, University of Wisconsin, Madison, WI

Hybrid ground-coupled heat pump systems (HyGCHPs) couple conventional ground-coupled heat pump (GCHP) equipment with supplemental heat rejection or extraction systems. In cooling-dominated climates, the use of a supplemental heat rejection system has been shown to significantly improve the economics of the system. However, the design and operation of HyGCHPs are more complex than GCHPs and the interaction between the
components, the building, and the ground are non-intuitive. This paper describes a simulation study integrating a HyGCHP model with an optimization engine in order to identify the optimal system design (i.e., component sizes) and control strategy that minimizes the life-cycle cost of the system for a range of different climates and building types.

Performance Augmentation of a Water Chiller System Using Nanofluids (CH-09-058)
M. S. Liu; M. C. Lin, Ph.D.; J. S. Liaw; R. Hu, Ph.D., Fellow ASHRAE; C. C. Wang, Ph.D., Fellow ASHRAE, Energy & Environment Research Laboratories, Hsinchu, Taiwan

This study examines the overall system performance of a water chiller subject to the influence of nanofluids. The system performance of a 10 RT water chiller (air conditioner) is conducted at a well controlled environment chamber. In summary, with the introduction of nanofluids, the coefficient of performance (COP) of the water chiller is increased by 5.15% relative to that without nanofluids.

Performance Comparison of Conventional and Chilled Ceiling/Displacement Ventilation Systems in Kuwait (RP-1438)
(CH-09-059)
Nesreen Ghaddar, Ph.D., Member, American University of Beirut, Beirut, Lebanon; Walid Chakroun, Ph.D., Member; Kamel Ghalii, Ph.D., Beirut Arab University, Riad El Solh, Lebanon; Ammar Bahman, Associate Member, Kuwait University, Safat, Kuwait

This paper studies by experimentation and modeling the use and performance of cooled ceiling and displacement ventilation (CC/DV) systems to buildings in Kuwait for the purpose of assessing added value in satisfying comfort at high indoor air quality and opportunities of energy savings in comparison with conventional systems under Kuwait hot and dry weather.

Performance Study of an HVAC Counter Flow Cooling Tower in a Humid Climate (CH-09-060)
Kamal Abdalla, Ph.D., University of Khartoum, Khartoum, Sudan; Fadi Mansour, Member, Bond Communications, Abu Dhabi, Abu Dhabi, United Arab Emirates; Esam Elsarrag, Ph.D., Member, Hoare Lea Consulting, Poole, Dorset, United Kingdom

Cooling towers are one of the prominent heat and mass transfer apparatus in widespread use. In this paper an experimental study of a forced draft counter flow cooling tower is implemented to investigate its performance and characteristics when using different mixture ratios of fresh air and return conditioned air (waste energy) to reduce the entering air wet bulb temperature to the cooling tower. This study showed that mixing exhaust air dumped from conditioned spaces with ambient fresh air in cooling towers in hot and humid regions significantly improves their performance and efficiency.

Pressure Relief Device Capacity Determination (CH-09-061)
Douglas T. Reindl, P.E., Member, University of Wisconsin-Madison, Madison, WI; Todd B. Jekel, Ph.D., Member, Industrial Refrigeration Consortium, Madison, WI

Pressure relief valves are the primary component in an engineered safety system intended to prevent the catastrophic failure of refrigeration equipment due to overpressure conditions that can occur during abnormal operating excursions. ASHRAE Standard 15 (ASHRAE 2007) prescribes methods for determining the mass flow rate (capacity) requirements for pressure relief devices aimed at protecting the pressure vessels and positive displacement compressors used in refrigeration systems. This paper reviews the pressure relief valve sizing methodology for vessels and presents approaches for relief capacity determination for other types of refrigeration equipment not explicitly covered in ASHRAE Standard 15 such as oil separators, shell-and-tube heat exchangers, plate-and-frame heat exchangers, oil cooling heat exchangers, and product storage tanks.

Stability of Temperature Control System in VAV Systems (CH-09-062)
Yuji Yamakawa, M.D., University of Tokyo, Shimotsuga-gun, Tochigi, Japan; Takanori Yamazaki, Ph.D., Oyama National College of Technology, Oyama, Tochigi, Japan; Kazuyuki Kamimura, Ph.D., Member, Yamatake Co., Ltd., Oota-ku, Tokyo, Japan; Shigeru Kurosu, Ph.D., Research Inst. “Crotech”, Chikusei, Ibaraki, Japan

Indoor air temperature control of a single zone space is studied. In air conditioning systems, no matter what the forcing—a step or impulse in setpoint or slight disturbance—the loop can easily get into huntings. The supply airflow rates to the space can be controlled by motorized dampers or by fan speed control. Such a VAV system is assumed to be essentially to the source of huntngs. To explore the possible existence of huntngs, a dynamical system model is formulated as a bilinear model with time-delayed feedback (by P or PI control actions), and a parametric analysis of the stability region is presented. This analysis is conducted to help us tune proportional-plus-integral-plus-derivative (PID) controllers for achieving good control performance.

Static Pressure Losses in 12", 14" and 16" Nonmetallic Flexible Ducts with Compression and Sag (RP-1333) (CH-09-063)
Charles Culp, Ph.D., P.E., Fellow ASHRAE, Texas A&M University, College Station, TX; David Cantrill, CxGBS, Atlanta, GA

A study was conducted to measure air pressure loss on non-metallic flexible ducts and included 12”, 14” and 16” diameter ducts on a flat surface and also positioned over joists on 24” centers. For this study, flexible ducts compression configurations were fully stretched and 4%, 15%, 30% and 45% compressed. All tests were performed in conformance to ASHRAE 120-1999, Methods of Testing to Determine Flow Resistance of HVAC Air Ducts and Fittings (ASHRAE 1999) with a positive pressure, blow-through configuration. The data from this study exhibit higher pressure loss than prior ACCA or ASHRAE data. Measured losses were 2 to 6 times higher than similar round steel ducts.

Study on Energy Conservation and Economical Condition of PEFC Apartment House (CH-09-064)
Hidemitsu Koyanagi; Hitoshi Hukao, Dr.Eng., Taisei Corporation, Yokohama, Japan

For reduction of greenhouse gas emissions, polymer electrolyte membrane fuel cells (PEFC) is promoted by the government in Japan as more efficient co-generation system (CGS). The purpose of this paper is to find the efficient energy supply system with PEFC in an apartment house, and the author proposed a “PEFC apartment house” as more efficient system than the current one (boiler and electric power), which consists of PEFC-CGS, thermal storage tanks, power network and management system. The author estimated about 14% reduction of annual primary energy consumption and about 28% reduction of carbon dioxide emissions.
The Integration of Radiant Components to Maintain Occupant Comfort in a Multifunctional Space (CH-09-065)

Peter Simmonds, Ph.D., Fellow ASHRAE; Patrick Wilkinson, Member; John Gautrey, P.E., Member, IBE Consulting Engineers, Sherman Oaks, CA

The conditioning system for a multifunctional forum space, in a modern museum building, is currently under design. The forum has many glazed surfaces which are transparent as requested by architects. As the space is multifunctional there is no predetermined strategy as to when the space will operate in a certain mode. Occupant comfort is expressed in terms of PMV/PPD as described in ASHRAE Standard 55-2004. Therefore the radiant heat exchange in the space and radiant balancing components have been investigated to see if the required conditions can be maintained. The air supply systems have been critically assessed to ensure the draft rating is not exceeded. The energy consumption of the different systems has also been assessed and the performance of the space and its conditioning systems were analyzed.

VFD Applications for Constant Volume Air Handling Units (CH-09-066)

YoungHum Cho, Student Member; Mingsheng Liu, Ph.D., P.E., Member, University of Nebraska–Lincoln, Omaha, NE; Gang Wang, Ph.D., Member, University of Texas A&M-Kingsville, Kingsville, TX; Jinrong Wang, P.E.; Timothy Rauscher, P.E., Omaha Public Power District, Omaha, NE

Traditional constant air volume systems consume significantly more energy than VAV systems because a constant amount of air is supplied to each zone regardless of the zone load. Due to seasonal and daily load variations, variable frequency drives (VFDs) can be installed on these constant air volume systems to reduce system energy consumption without retrofitting the terminal box. This paper presents the procedures for supply fan speed control and results of its application in an office building. The results show electricity savings of 23% and gas savings of 19% over a six-month period.

Criteria for Safe Air and Water in Buildings

Track: Indoor Environmental Topics

TUESDAY, 1/27,
1:30 p.m.–3 p.m.

Seminar 52 (Intermediate)

1. Defining Safe Building Air
Francis Offermann, P.E., Member, Indoor Environmental Engineering, San Francisco, CA

2. Defining Safe Building Water
William F. McCoy, Ph.D., Member, Phigenics, LLC, Naperville, IL

3. Prospective Solutions: Issues in the Definition of Safe Indoor Environments
Hal Levin, Fellow ASHRAE, Building Ecology Research Group, Santa Cruz, CA

How to Design Energy Recovery Systems to Comply with 90.1, 189.1P and LEED®

Track: Sustainability

How to Design Energy Recovery Systems to Comply with 90.1, 189.1P and LEED®

TUESDAY, 1/27,
1:30 p.m.–3 p.m.

Seminar 53 (Intermediate)

1. Calculating System Performance to Meet ASHRAE Standards and Project Sustainability Requirements
Ronnie Moffitt, P.E., Member, Trane, Inc., Lexington, KY

2. Component Ratings Leading to Sustainable System Performance
Matthew Friedlander, Member, Renewaire LLC, Madison, WI

3. Chicago Case Studies Using ERV’s: Green Exchange and UNO Charter Schools
Sachin Anand, dbHMS, Chicago, IL; Paul Pieper, P.Eng., Member, Venmar CES, Inc., St. Leonard d’Aston, QC, Canada

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Tuesday, 1/27, 1:30 p.m.–3 p.m.

Seminar 54 (Intermediate)

Methods of Reducing the Impact of Energy Use on Air Cleaning Devices

Track: Sustainability
Water Tower Parlor (6)
Sponsor: 5.4 Industrial Process Air Cleaning (Air Pollution Control)
Chair: Gerhard W. Knutson, Ph.D., Associate Member, Knutson Ventilation, Inc., Edina, MN

Industrial air cleaning devices use considerable energy due to their high static pressure. This seminar looks at ways to reduce the energy required by these devices.

1. Recirculating Air Filtration
   Jing Wang, Ph.D., University of Minnesota, Minneapolis

2. How to Effectively and Safely Use Energy Recovery with an Industrial Air Cleaning Device
   Wayne M. Lawton, P.E., Member, Merrick, Aurora, CO

3. Energy Conservation in ACD
   Gerhard Knutson, Associate Member, Knutson Ventilation Inc, Edina, MN

Tuesday, 1/27, 3:15 p.m.–4:45 p.m.

Seminar 55 (Basic)

Issues Update: Emerging Public Policy Issues for Climate Change and Buildings

Track: Sustainability
Crystal (3)
Sponsor: Advocacy Committee, 2.5 Global Climate Change
Chair: Ryan M. Colker, J.D., Associate Member, ASHRAE, Washington, DC

As concern grows worldwide on the impact of increasing emissions associated with energy use and its effect on global climate, future policies will look at buildings as a significant source for greenhouse gas (GHG) emission reductions. Energy use in residential, commercial and public buildings account for 35 percent of total global energy consumption and about 30 percent of global GHG emissions. With the election of a new U.S. President and Congress, a new policy on addressing climate change is very likely. This session examines the domestic outlook on climate change policy and the role of the building community in future policy related decisions.

1. Climate Change, Buildings and the New U.S. Political Landscape
   Debbie Boger, World Resources Institute, Washington, DC

2. A Climate Perspective on the Building Stock: Where Are the Opportunities?
   Adam Hinge, Member, Sustainable Energy Partnerships, Tarrytown, NY

3. North American Players, Policies, and Activities
   Jeff Harris, Alliance to Save Energy, Washington, DC

Tuesday, 1/27, 3:15 p.m.–4:45 p.m.

Seminar 56 (Intermediate)

Minimum Humidity Specification for Sustainability and Comfort

Track: Applications
Salons 8/9 (3)
Sponsor: 5.11 Humidifying Equipment
Chair: Larry J. Hughes, P.E., Member, Alpha Engineering, Inc., Newark, DE

The lower humidity limit recommendation was removed from ASHRAE Standard 55–2004 Thermal Environmental Conditions for Human Occupancy. This has resulted in confusion within the industry and potentially a negative impact on overall sustainability as well as occupant comfort. This forum discusses the engineering need for setting a lower humidity specification in buildings.

1. Understanding and Reducing Energy and Water Consumption in Humidification System Design
   David Schwaller, Associate Member, DriSteem Corp., Eden Prairie, MN

2. Supporting Sustainable Design with Efficient Steam Humidification Solutions
   James Lundgreen, Associate Member, DriSteem Corp., Eden Prairie, MN

3. Sustainable Environments in the Printing Industry through Proper Control of the Indoor Relative Humidity
   L. Gary Berlin, Nortec, Ottawa, ON, Canada

4. Introducing New Ashrae Standard 164.1: Method of Test for Residential Humidifiers
   Roger Pasch, P.E., Member, Pasch Enterprises LLC, Eden Prairie, MN
ASHRAE's Conference Program at McCormick Place

Wednesday Jan. 28, 9:00 a.m. to 1:30 p.m.
Wednesday Welcome Reception Begins at 8:30 a.m.

Wednesday Program is included with the full conference registration.

WEDNESDAY 1/28, 9 a.m.–10:30 a.m.
Seminar 57 (Basic)

Utility Water Conservation Strategies for Sustainable Urban Design
Track: Sustainability
Salons S104
Sponsor: 3.6 Water Treatment, 8.6 Cooling Towers and Evaporative Condensers
Chair: Scott E. Mayes, Member, Scott's Square Deal, Olathe, KS

Water is rapidly becoming the new energy; especially in terms of conservation and sustainability. Increasingly, Federal, state, and local authorities, as well as building owners and operators, are seeking ways in which to more efficiently utilize our water resources. Several ASHRAE standards committees are considering the affect water has on the application of those standards (e.g. Standard 90.1, and the proposed Standard 189.1); and ASHRAE, in conjunction with other relevant organizations, is now engaged in the development of Standard 191: "Standard for the Efficient Use of Water in Building, Site, and Mechanical Systems." This seminar presents ideas on how buildings and building systems can be designed and operated to achieve significant water conservation.

1. Achieving Sustainability in Cooling Towers and Evaporative Condensers through a Chemical Free and Zero Discharge Water Treatment Program
Charles “Chuck” Sanderson, Jr., Member, Magnatech Corp., Fort Wayne, IN

2. Reuse of Cooling Tower Blow-Down Water for Landscape Irrigation: Green, Clean and Sustainable
Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV

Seminar 58 (Intermediate)

Achieving Sustainability and Energy Reduction through the IAQ Procedure: Case Studies of Success
Track: Indoor Environmental Topics
Salons S105BC
Sponsor: 2.3 Gaseous Air Contaminants and Gas Contaminant Removal Equipment, 2.4 Particulate Air Contaminants and Particulate Contaminant Removal Equipment
Chair: H. E. Barney Burroughs, Presidential Fellow Life Member, Building Wellness Consultancy, Inc., Alpharetta, GA

The IAQ Procedure has been a component of Standard 62 compliance since the earliest version in 1973. This alternate pathway for achieving acceptable indoor environments is fulfilled through rigorous material selection; the usage of mass balance equations; and through the use of enhanced particulate filtration and gas phase air cleaning as an alternate to dilution with outdoor air. Because less outdoor is required, the method yields remarkable energy usage and cost reduction. However, the inherent requirements of Standard 62.1 compliance have increased; the cleanliness of outdoor air as a diluant is increasing undependable; and the cost of energy for treating hot and humid outdoor air is increasing exponentially. This
seminar presents detailed performance criterion and documents energy savings in a series of successful application case studies of buildings that have enhanced their sustainability through application of the benefits of the IAQ Procedure.

1. Attaining Sustainability Using IAQP in San Antonio Schools
   Gerald Lamping, Member, NE Independent School District, San Antonio, TX

2. Attaining Sustainability Using IAQP in Museums
   Chris Muller, Member, Purafil, Inc., Norcross, GA

3. Attaining Sustainability Using IAQP: Experiences with TVOC Testing and Analysis in Field Studies
   Charlene Bayer, Ph.D., Member, Georgia Tech Research Institute, Atlanta, GA

4. Attaining Sustainability Using IAQP: Documentation of Successful Building Performance in 15 IAQP Sites in Atlanta
   H.E. Barney Burroughs, Presidential Fellow Life Member, Building Wellness Consultancy, Alpharetta, GA

Seminar 59 (Intermediate)

Wednesday, 1/28, 9 a.m.–10:30 a.m.

Airflow Measurement for Small Forced-Air Systems
Track: Systems and Equipment
Salons S105A
Sponsor: 6.3 Central Forced Air Heating and Cooling Systems
Chair: Jeffrey A. Siegel, Ph.D., Member, University of Texas at Austin, Austin, TX

Accurate airflow measurement is crucial to the sustainable operation of small forced-air systems. However, most of the tools and procedures available for flow measurement in these systems are designed for large commercial systems. Typical differences for smaller systems, including shorter and more complicated duct runs, complex duct and equipment geometries near the air handler, and varied register sizes and placement, can lead to erroneous flow measurements. These issues have led to the design and application of a variety of measurement tools that are designed for residential and light-commercial systems. The objective of this seminar is to present several of these tools and techniques and explore their accuracy and utility. Given the importance of high-quality flow measurements, applicable tools are essential for the verification of high-performance operation of small forced-air systems.

   Paul W. Francisco, Member, University of Illinois, Urbana-Champaign, Champaign, IL

2. One of These Things Is Not Like the Other: Flowhoods, Garbage Bags, Laundry Baskets and Cardboard Boxes
   Iain S. Walker, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

3. Indoor Cooling Airflow Evaluation Using Airside Temperature Difference
   Keith A. Temple, Ph.D., P.E., Member, Field Diagnostic Services, Inc., Fairless Hills, PA

Seminar 60 (Basic)

Wednesday, 1/28, 9 a.m.–10:30 a.m.

Basics of Load Calculations
Track: Fundamentals
Salons S105D
Sponsor: 4.1 Load Calculation Data and Procedures, 4.5 Fenestration
Chair: Glenn Friedman, P.Eng., Member, Taylor Engineering, Alameda, CA

This seminar shall review the basics of load calculations, the fundamental starting point of HVAC design. An overview of what is a room load and the components of a room load and a more detailed discussion of plenums and how to take them into account in load calculations are presented. Also, an examination of solar loads and the effects of shading on loads and the effects of thermal bridging on load calculations are addressed. Lastly, basic assumptions made in load calculations of well mixed spaces and the differences to take into account when performing a load calculation on an underfloor air distribution (UFAD) spaces that is not a thermally well mixed space is presented.

1. What is a Room Load vs. System Load
   Stephen Roth, P.E., Member, Autodesk, Inc., San Rafael, CA

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

3. Glass Loads Including Shading
   Charles S. Barnaby, Member, Wrightsoft Corp., Lexington, MA

4. Load Simplifications such as Well-Mixed Space
   Curtis Pederson, State College, PA
Building Information Model (BIM) Application Issues for the Integrated Design Process

Track: Applications

Salons S106A
Sponsor: 7.1 Integrated Building Design
Chair: Charles E. Gulledge, III, P.E., Member, AC Corp., Greensboro, NC

This program explores building information modeling (BIM) application issues as they relate to developing high-performance, integrated design solutions. The collaborative segment explores the connectivity and benefits of BIM through the use of consistent data sets and parametric responses to single discipline changes. The specific role of the HVAC engineer is examined to identify new skill sets that will be required to contribute to a BIM-enabled design process. A concluding project is reviewed to demonstrate the successful impacts of a developed and built solution utilizing BIM.

1. The Benefits of BIM to High Performance Building Design
   Dennis Knight, P.E., Member, Liollio Architecture, Charleston, SC

2. BIM and the Role of the HVAC Engineer
   Chris Wilkins, P.E., Member, Hallam-ICS, South Burlington, VT

3. A Successfully Integrated BIM Project
   Steven Rosen, Member, Autodesk, Waltham, MA

Liability and Litigation Issues in Green Design, Part 1

Track: Business Management

Salons S103BC
Sponsor: 1.7 Business Management & General Legal Education, 2.8 Building Environmental Impacts and Sustainability
Chair: E. Mitchell Swann, P.E., Member, MDC Systems, LLC, Paoli, PA

The program looks at liability and litigation issues that arise in green building projects. It will delve into some of the design, construction and operational circumstances that have led to trouble on green building projects and attempt to cover some guidance on how to avoid them. The program probes several facets of green building disputes: are they special? Are they specific to green buildings? How does historical “custom & practice” relate to the green building context? Do current contracts adequately address the potential problems and risks?

1. The Lawyer’s Role in Building Green
   Shari Shapiro, J.D., Obermayer Rebmann Maxwell & Hippel LLP, Philadelphia, PA

2. Exposed in Green: Insurance Issues for Design Professionals
   Rob Hughes, Ames & Gough, West Chester, PA

3. Risk Management and Green Design: Balancing Contract Language with the Evolving Standard of Care
   Frederick F. Butters, Frederick F. Butters, PLLC, Bloomfields Hills, MI

Demand Controlled Ventilation: Meeting the Requirements of Standard 62.1

Track: Indoor Environmental Topics

Salons S104
Sponsor: SSPC 62.1
Chair: Roger Hedrick, Member, Architectural Energy Corp., Boulder, CO

Standard 62.1-2007 currently allows the use of demand controlled ventilation or dynamic reset schemes, but the requirements for such systems are not defined in any detail. The change to ventilation rate calculations using the sum of per area and per person ventilation rates, as well as the use of Zone Air Distribution Effectiveness and System Ventilation Efficiency means that simple control approaches based on a single CO₂ setpoint will not provide optimal control and may not meet the requirements of the standard. This seminar presents information which will help the designer understand
the basics of dynamic reset as described in the standard, including CO₂-based DCV, and the complexities involved in applying DCV, especially to multiple zone ventilation systems.

1. How Much May Ventilation Rates Vary and Still Comply With ASHRAE 62.1?
Hoy Bohanon, P.E., Member, Bohanon Engineering, PLLC, Winston-Salem, NC

2. Challenges of DCV for Multiple-Zone Systems
Dennis A. Stanke, Fellow ASHRAE, Trane Commercial Systems, Ingersoll Rand, La Crosse, WI
temperature, lamp orientation, and cycling frequency on lamp output and life are presented. Implications of the results of these studies for lamp rating and system design are discussed.

1. Ambient Condition Response, Depreciation, and Life Testing of Germicidal UV Lamps
Josephine Lau, Student Member; William P. Bahnfleth, Ph.D., P.E., Fellow ASHRAE, Penn State, University Park, PA

2. Effects of Operating Conditions on Germicidal UV Lamp Performance
Rien van Bentham, Member, Philips Lighting B.V., Roosendaal, Netherlands

3. Accounting for Operating Conditions in UVGI Lamp Rating and System Design
William P. Bahnfleth, Ph.D., P.E., Fellow ASHRAE; Josephine Lau, Student Member, Penn State, University Park, PA; Rien van Bentham, Member; Jaak Geboers, Associate Member, Philips Lighting B.V., Roosendaal, Netherlands

Forum 16 (Basic)
Wednesday, 1/28, 10:45 a.m.–11:45 a.m.

Is Contaminant Control Needed for R22 Conversions?

Track: Refrigeration

Salons S105A
Sponsor: 3.3 Refrigerant Contaminant Control, 3.4 Lubrication, 3.2 Refrigerant System Chemistry
Chair: Ganesan Sundaresan, P.E., Fellow ASHRAE, Emerson Climate Control Technologies, Sidney, OH

R-22 is being phased out by 2010 in new equipment. Many current users of R-22 equipment in commercial refrigeration applications ranging from medium temperature to low temperature are in the early stages of converting from HCFC-22 to HFC-containing refrigerants. One critical consideration is the lubricant return characteristics with the new HFC components of the HCFC-free refrigerant. Moisture pick up and contaminant circulation by POEs should be addressed; compressor oil circulation plays an important role; use of oil separators in the equipment and use of filter driers in the liquid line are other considerations. In R-22 conversions, time is money and contractors are aware of this fact. This forum intends to bring all these facts to the ASHRAE audience in such a way that available information is disseminated and relevant contaminant control components and procedures are discussed.

Forum 17 (Intermediate)
Wednesday, 1/28, 10:45 a.m.–11:45 a.m.

Sustainability vs. Safety in Labs

Track: Sustainability

Salons S105BC
Sponsor: 9.10 Laboratory Systems, 9.10 Laboratory Systems, 2.2 Plant and Animal Environment, 2.1 Physiology and Human Environment
Chair: Rajendera Kapoor, P.E., Member, Atlanta, GA

Mission critical facilities are being asked to reduce energy consumption and thus the carbon footprint, but can it be done at cost of health and safety of current generation or at the cost of reliability of the systems that can cause explosions or unwanted failures? Are engineers up to speed on all the processes, reactions current and future use? What happens if chemists develop new processes or someone places different substances in the oven, is there sufficient artificial intelligence or monitoring to mitigate such risks? What else can be done to obtain goals of 30% reduction and ultimately carbon neutral laboratories? This forum addresses all types of laboratories.

WEDNESDAY 1/28,
Noon–1:30 p.m.
Seminar 67 (Basic)
Wednesday, 1/28, Noon–1:30 p.m.

⚠️ Back to Basics: How Does a Liquid Chiller Work?

Track: Systems and Equipment

Salons S106A
Sponsor: 8.2 Centrifugal Machines
Chair: Stephen W. Duda, P.E., Member, Ross & Baruzzini, Inc., St. Louis, MO
Many people view a liquid chiller as a black box that mysteriously produces cold water, in exchange for warmer water and an electric (or other fuel) input. This seminar attempts to take some of that mystery away by exploring exactly what happens inside the chiller to produce that cold water. The presenters address the vapor-compression refrigeration cycle, how a centrifugal chiller works (using water-cooled as an example) and how a positive-displacement compressor works (using air-cooled as an example).

1. The Vapor-Compression Refrigeration Cycle
Douglas T. Reindl, Ph.D., P.E., Member, University of Wisconsin-Madison, Madison, WI

2. How a Water-Cooled Centrifugal Chiller Works
Ajay S. Iyengar, Member, Carrier Corp., Charlotte, NC

3. How an Air-Cooled Positive-Displacement Chiller Works
Phillip A. Johnson, P.E., Member, McQuay International, Staunton, VA

Seminar 68 (Intermediate)
Wednesday, 1/28, Noon–1:30 p.m.

Case Studies in Sustainable Retrofit to Reduce Energy of Existing Buildings
Track: Applications
Salons S105BC
Sponsor: 9.1 Large Building Air-Conditioning Systems
Chair: Phillip M. Trafton, Member, Donald F. Dickerson Associates, Van Nuys, CA

This seminar highlights case studies of large HVAC systems. These systems significantly increased efficiency and improved performance with reduced energy use. The case studies address air side and chilled water systems, a retrofit of a multi-zone system to a VAV system while re-using air distribution components and a new HVAC concept and the retro-commissioning and LEED relationships for a large Federal building.

1. Commercial Building Multi-Zone Unit Retrofit with Oil-Less Refrigerant Compressor Technology Resulting in 40 Percent Energy Savings
   John Kuempel, Jr, Member, Debra-Kuempel, Cincinnati, OH

2. The Very Model of a Model Major Campus
   Howard J. McKew, P.E., Member, RDK Engineers, Andover, MA

3. Large Federal Complex—Concept and Planning
   Jeff J. Traylor, Member, EMCOR, Durham, NC

Seminar 69 (Intermediate)
Wednesday, 1/28, Noon–1:30 p.m.

Commissioning for Different Programs to Support Sustainable Urban Environments
Track: Sustainability
Salons S103BC
Sponsor: 7.9 Building Commissioning
Chair: Roger Lautz, P.E., Member, Henneman Engineering, Brookfield, WI

Different sustainability programs (LEED, Energy Star, IPMVP) have different requirements for commissioning. This seminar discusses the differences among these programs and how to properly commission facilities in sustainable urban environments.

1. Commissioning High Performance Buildings
   Harry Enck, Commissioning & Green Build Solutions Inc, Buford, GA

2. Energy Star and the Commissioning Process
   Gerald Kettler, Associate Member, Air Engineering and Testing Inc, Dallas, TX

3. M&V for Commissioning Projects
   David Claridge, Member, Texas A&M University, College Station, TX

Seminar 70 (Intermediate)
Wednesday, 1/28, Noon–1:30 p.m.

Leveraging Tools and Processes for Successful Projects: Building Information Modeling and Integrated Project Delivery
Track: Business Management
Salons S104
Chair: Robert E. Middlebrooks, Autodesk, Inc., Chesapeake, VA

Building information modeling is a very useful tool for collaboration and visualization, and can be a catalyst for change, but true collaboration and success only comes when the design process supports it. Integrated project delivery, supported by BIM, leverages the best of both tools and processes to empower team members. The advantages of BIM tools and the value of the IPD Process, while aligning the two in order to produce an
efficient workflow, are discussed. Review of workflows, inhibitors, contracts and strategies for successful projects as well as successful examples are presented.

Seminar 71 (Intermediate)
Wednesday, 1/28, Noon–1:30 p.m.

Low Carbon Cities: Present and Future
Track: Sustainability
Salons S105A
Sponsor: 2.8 Building Environmental Impacts and Sustainability
Chair: Frank A. Mills, P.E., Member, SKM, Manchester, United Kingdom

Modern cities rely on large amounts of energy for everyday life and prosperity. As fossil fuels run out and strategies to combat climate change are developed, cities must plan for low and zero carbon futures in order to survive. Whilst this might seem a daunting task many major cities around the world are making and implementing such plans.

   Robert Clegg, Student Member, Brunel University, Ormskirk, United Kingdom

2. Energy Plans for a Long Term Future of Chicago City
   Suzanne Malec-McKenna, Chicago Dept. of Environment, Chicago, IL

3. Reducing Climate Impacts in the City of Chicago
   Katie McClain, Clinton Climate Initiative, Chicago, IL

4. Media City, Salford: A Modern Low Carbon City in the Making
   Francis Mills, Member, SKM, Manchester, United Kingdom

Seminar 72 (Basic)
Wednesday, 1/28, Noon–1:30 p.m.

⚠️ VFDs Deliver Real Energy Savings
Track: Systems and Equipment
Salons S105D
Sponsor: 1.11 Electric Motors and Motor Control
Chair: John Tolbert, Jr, Member, Bristol Compressors, Bristol, VA

With energy costs becoming more and more of an issue along with the fact that HVAC products consume a very large percentage of the available electrical generation capacity, the application of variable speed drives in these systems is becoming more viable. This program explores the potential for savings, both monetary and power, by employing the technology to all system prime movers.

1. VFDs in HVAC Applications: They’re Everywhere
   Kenneth R. Luther, Member, ITT Water Group, Anthem, AZ

2. Using VFDs to Save Energy in Variable Torque HVAC Applications
   Ken Fonstad, Danfoss Drives, Milwaukee, WI