PROGRAM

Sessions and speakers are subject to change.
Check www.ashrae.org/louisville for the most current technical program.

Tracks Legend

- APPLICATIONS
- BUSINESS MANAGEMENT
- EXERGY
- FUNDAMENTALS
- HIGH PERFORMANCE SYSTEMS
- INDOOR AIR QUALITY
- LARGE BUILDING SYSTEMS
- OPERATIONAL TOPICS
- REFRIGERATION
- SUSTAINABILITY/LEED
- SYSTEMS AND EQUIPMENT

Sunday

- Survivor's guide for businesses.
- Technical plenary: Adapting for 3°C climate change.
- GSHP systems: sessions on design tools for residential installations and design of hybrid systems.
- Healthcare facility energy use.
- Moisture management sessions on part-load conditions and case studies in litigation.
- Get up to speed on ASHRAE's new commissioning guideline.

SUNDAY, 6/21
8 A.M.–9:30 A.M.

Transactions 1 (Intermediate)

Improving Load Calculations for Fenestrations with Shading Devices

Track: Fundamentals

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

Load calculations are the foundation of good HVAC design. Fenestration represents one of the largest factors of building loads. Shading can have a significant effect on fenestration loads. This session explores fenestration shading.

1. Determining Off-Normal Solar Optical Properties of Drapery Fabrics (LO-09-001)
Nathan A. Kotey, Student Member; John L. Wright, Ph.D., P.Eng., Member; Michael R. Collins, Ph.D., Associate Member, University of Waterloo, Waterloo, ON, Canada

2. Solar Gain Through Windows with Shading Devices: Simulation versus Measurement (LO-09-002)
Nathan A. Kotey, Student Member; John L. Wright, Ph.D., P.Eng., Member, University of Waterloo, Waterloo, ON, Canada; Charles S. Barnaby, Member, Wrightsoft Corp., Lexington, MA; Michael R. Collins, Ph.D., Associate Member, University of Waterloo, Waterloo, ON, Canada

3. Improving Load Calculations for Fenestration with Shading Devices (RP-1311) (LO-09-003)
Charles S. Barnaby, Member, Wrightsoft Corp., Lexington, MA; John L. Wright, Ph.D., P.Eng., Member; Michael R. Collins, Ph.D., Associate Member, University of Waterloo, Waterloo, ON, Canada

Seminar 1 (Intermediate)

Energy Efficiency and Application of Water to Water Heat Pumps in Residential Installations

Track: Applications

Sponsor: 9.4 Applied Heat Pump/Heat Recovery Systems, 6.8 Geothermal Energy Utilization
Chair: Jitendra B. Singh, P.E., Member, J and P Engineers P.A., Linwood, NJ

With the rapidly expanding use of water to water heat pumps for sustainability and flexibility of design, this seminar looks at a wide variety of residential applications from across the country; reviewing the design parameters, the economics, the efficiency and the overall benefits.

1. Residential Applications of Geothermal Water to Water Heat Pumps on the West Coast
Lisa Meline, P.E., Member, Meline Engineering, Sacramento, CA

2. Residential Applications of Geothermal Water to Water Heat Pumps in Eastern Markets
Art W. Hunt, P.E., Member, J and P Engineers P.A., Linwood, NJ

3. Residential Radiant Floor Application using a Geothermal Two Stage Water to Water Heat Pump
Howard Newton, Member, FHP–Bosch Group, Fort Lauderdale, FL

Seminar 2 (Basic)

Energy Use and Efficiency in Healthcare Facilities

Track: Sustainability/LEED

Sponsor: 9.6 Healthcare Facilities
Chair: Michael Meteyer, P.E., Member, Erdman Co., Madison, WI

Understanding energy use in hospitals is an important step as ASHRAE works towards finding ways to making them more energy efficient. This seminar presents some recent work on this topic.

1. Impact of Changes in Standard 90.1 on Healthcare Facilities
Jeff Boldt, PE, Member, KJWW Engineering Consultants, Madison, WI

2. Energy Modeling Following Standard 90.1-2004 Appendix G for the upcoming AEDG on Small Hospitals and Healthcare Facilities
Ian Doebber, Associate Member, National Renewable Energy Lab, Golden, CO

3. Energy Benchmarking System for Hospitals
Brett Singer, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

4. Report on the Method of Test for Reporting Heat Gain and Energy Use from Medical Imagining Systems (1343-RP)
Dan Koenigshofer, PE, Member, IES Engineers–Dewberry, Chapel Hill, NC

Seminar 3 (Intermediate)

Avoiding Moisture and Humidity Problems During Part-Load Hours

Track: Operational Topics

Sponsor: 1.12 Moisture Management in Buildings, 8.12 Desiccant Dehumidification Equipment and Components
Chair: Lewis Harriman, Member, Mason-Grant, Portsmouth, NH

At part-load—when outdoor temperatures are moderate but the dew point remains high—unitary and packaged rooftop cooling equipment often has difficulty keeping the dew point low enough to provide comfort and avoid mold problems. The problems multiply if ventilation air adds more humidity to the space. This seminar discusses the systems which are most prone to such difficulties, and suggests how designers can anticipate and avoid high-humidity problems at part-load.

1. Research which Explains and Quantifies Humidity Problems at Part-Load
Hugh Henderson, P.E., Member, CDH Energy, Cazenovia, NY

2. Using Variable-Air-Volume (VAV) Cooling Systems to Avoid High Humidity at Part-Load
John Murphy, Member, Trane, LaCrosse, WI

3. Simplified Part-Load Analysis to Identify when to Add Dedicated Dehumidification
Harry Milliken, Member, Desert Aire, Lewiston, ME

4. Case Histories of Part-Load High Humidity Problems; How Retrofits Were Accomplished and What They Cost
Michael Hayes, Member, Munters USA, Atlanta, GA

Seminar 4 (Intermediate)

Site Energy, Source Energy and Carbon Emission Metrics and Issues

Track: Sustainability/LEED

Sponsor: 2.8 Building Environmental Impacts and Sustainability, 1.10 Cogeneration Systems, 2.5 Global Climate Change
Chair: Erica Reading, Associate Member, Package Products, SPX Cooling Technologies, Overland Park, KS

This seminar provides different perspectives on methodologies, descriptors and technology options to reduce greenhouse gas emissions related to building energy consumption. Limitations and challenges associated with site energy, source (full-fuel cycle) energy, and greenhouse gas emissions calculations are explored.

1. Greenhouse Gas Emissions Estimates and Metrics
Michael Deru, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

2. Electric Perspectives on Greenhouse Gas Emissions and Efficiency Measures
Donald M. Brundage, P.E., Member, Southern Company Services, Atlanta, GA

3. Natural Gas Options to Reduce Greenhouse Gas Emissions
Neil P. Leslie, P.E., Member, Gas Technology Institute, Des Plaines, IL

Seminar 5 (Basic)

Benefits of Using Data from Your DDC System

Track: Applications

Sponsor: 1.4 Control Theory and Application, 1.5 Computer Applications
Chair: Michael A. Pouchak, P.E., Member, Honeywell, Golden Valley, MN

Building automation systems and DDC controls continue to expand in power, flexibility, ease of use and features. This seminar explores current DDC control applications with examples of green buildings' DDC applications, design evaluation and monitoring of DDC systems, and platform-neutral DDC control systems. Building on the powerful base of DDC controls includes a new generation of integrated network applications and information technology-aware networks, video and media servers, cell phone/PDA-aware information servers, Internet email, software services and HVAC information exchange database applications.

1. Green Building DDC Case Study, a Solar Hot Water Learning Experience!
Gaylen V. Atkinson, P.E., Member, Atkinson Electronics, Salt Lake City, UT

2. Case Study: Monitoring and Feedback of Your Design from Your DDC System
Mike McDermott, Member, Environmental Systems Design, Chicago, IL

3. Frameworks for Platform-Neutral DDC Data Control and Analysis
Scott Muench, Member, Tridium, Richmond, VA

Seminar 6 (Intermediate)

Cleanroom Airflow Simulation, Pressurization, Filtration and Air Quality Control Strategies

Track: Applications

Sponsor: 9.11 Clean Spaces
Chair: Wei Sun, P.E., Member, Engsysco, Inc., Ann Arbor, MI

Air quality management in high-tech cleanrooms is a very complex task. In addition to typical outside air and VOC level controls, cleanrooms also require stringent room air cleanliness, pressure and filtration controls to minimize airborne cross contamination due to particle and microbial migrations along airflows and air leakage paths. Studies on these complex and dynamic characteristics will help develop better airborne control tools and strategies which are often achieved automatically and optimized through building management system. This seminar addresses various cleanroom indoor airflow simulation methods, effective airlock control, automatic suite pressurization and new filtration technology down to very fine nano particles.

1. Indoor Airflow Simulation Strategies for Design of Clean Spaces
Kishor Khankari, Ph.D., Member, Syska Hennessy Group, Inc., Ann Arbor, MI

2. Airlock Transient Characteristics, Airborne Decontamination Effectiveness and Automatic Suite Pressurization Controls
Wei Sun, P.E., Member, Engsysco, Inc., Ann Arbor, MI

3. Air Filtration Performance Down to Nano Particles
R. Vijayakumar, Ph.D., Member, AERFIL, LLC, Liverpool, NY; P. Tronville, Ph.D., Member, Politecnico di Torino, Turin, Italy

Seminar 7 (Intermediate)

ASHRAE Members' Survival Guide: Keeping Your Business Alive and Well During Difficult Economic Times

Track: Business Management

Sponsor: 1.7 Business, Management & General Legal Education
Chair: Leon Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV

Many ASHRAE members' firms and businesses are facing challenging issues during the current economic downturn. Retaining and/or acquiring new business; staffing concerns; shrinking sources of credit; slow (or no) pay clients; cash flow crunches; and on and on. This seminar presents ideas on how to deal with some of the myriad legal and business management issues we are facing in today's thorny business environment (without the use of aspirin and/or scotch).

1. Using Your Backlog, Sales Prospects and Proposal List to Forecast Manpower Needs and Expected Costs
Warren G. Hahn, P.E., Member, Hahn Engineering, Tampa, FL

2. The True Cost of Late Receivables: How It Affects the Bottom Line
Michael C. Connor, P.E., Member, Pivotal Point Group, Alpharetta, GA

3. Contract and Billing Practices to Help Avoid Singing the "Cash Flow Blues"
Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV

SUNDAY, 6/21
9:45 A.M.–10:45 A.M.

Plenary (Intermediate)

Adapting Buildings and Cities for 3°C of Climate Change

Track: Sustainability/LEED

Sponsor: Conferences and Expositions Committee
Chair: Sue Roaf, Ph.D., Heriot Watt University, Edinburgh, Scotland, United Kingdom

Sue Roaf outlines a range of building and climate related risks that individuals may be facing in the future and then present a range of actions that homeowners and legislators can begin to take to future-proof lifestyles in the building and cities around the world against the predictable and growing challenges of the 21st century. At the heart of the solutions available is the concept of Low Carbon Buildings and the talk defines what these are and how we can help them to happen. She also discusses the challenge of re-designing the built environment, society and economy for the predicted 3°C of climate change by 2065.

The Technical Program will be updated, when necessary, at www.ashrae.org/louisville

SUNDAY, 6/21 11 A.M.–12:30 P.M.

Transactions 2 (Intermediate)

Design Tools for Modeling Hybrid Geothermal Heat Pump (GHP) Systems

Track: Sustainability/LEED

Sponsor: 6.8 Geothermal Energy Utilization, 6.7 Solar Energy Utilization
Chair: Lisa M. Meline, P.E., Member, Meline Engineering Corp., Sacramento, CA

This session presents two design tools for modeling hybrid geothermal heat pump (GHP) systems. The first paper presents a detailed borehole heat exchanger model, cast as a TRNSYS component model, for use in ground source heat pump system simulations with optimization of system subcomponents. The remaining papers focus on the sizing of either the solar collector array or the cooling tower for a hybrid GHP system based on using the utilizability method and annual equivalent full load hour concept respectively. With typical design parameters available to practitioners, these methods may be used to estimate the total ground loop length for stand-alone GHP system along with annual energy required to balance the annual ground loads.

1. Simulation Model for Ground Loop Heat Exchangers (LO-09-004)
Cenk C. Yavuzturk, Ph.D., Member, University of Hartford, Hartford, CT; Andrew D. Chiasson, Ph.D., P.E., Member, Consultant, Dublin, OH; John E. Nydahl, Ph.D., University of Wyoming, Laramie, WY

2. A Design Tool for Hybrid Geothermal Heat Pump Systems in Heating-Dominated Buildings (LO-09-005)
Andrew D. Chiasson, P.E., Member, Independent Consultant, Dublin, OH; Cenk C. Yavuzturk, Ph.D., Member, University of Hartford, Hartford, CT

3. A Design Tool for Hybrid Geothermal Heat Pump Systems in Cooling-Dominated Buildings (LO-09-006)
Andrew D. Chiasson, P.E., Member, Independent Consultant, Dublin, OH; Cenk C. Yavuzturk, Ph.D., Member, University of Hartford, Hartford, CT

Seminar 8 (Intermediate)

Case Studies of Moisture Management Issues in Litigation

Track: Applications

Sponsor: 1.12 Moisture Management in Buildings, 1.7 Business, Management & General Legal Education
Chair: Neil Leslie, P.E., Member, Gas Technology Institute, Des Plaines, IL

The three speakers have seen hundreds of buildings where moisture management has failed, resulting in significant litigation expense. Come learn from some of their experiences.

1. Outpatient Center Failures in Moisture Management
Holly Bailey, P.E., Member, Bailey Engineering Corp., Jupiter, FL

2. A Collection of Issues from Numerous Schools in Texas
Rodney Lewis, P.E., Fellow Life Member, Rodney H. Lewis Associates, Inc., Houston, TX

3. Moisture Control Issues in Vented Attic Spaces
Ray Patenaude, P.E., Member, The Holmes Agency, Tierra Verde, FL

Seminar 9 (Intermediate)

Control of Naturally Ventilated Buildings

Track: Indoor Air Quality

Sponsor: 1.4 Control Theory and Application, 7.5 Smart Building Systems, 9.6 Healthcare Facilities, 9.7 Educational Facilities
Chair: Frank Shadpour, P.E., Fellow ASHRAE, Shadpour Consulting Engineers, Inc., San Diego, CA

Designing a naturally ventilated building is not just about having operable windows. How do we control it? The old paradigm of step-by-step independent design no longer works. Today, collaboration between engineers, owners and architects is required for the achievement of successful buildings. This seminar examines the challenges associated with the control of naturally ventilated facilities. It also previews a number of proposed solutions associated with the design and construction of naturally ventilated buildings with a focus on educational and healthcare facilities. As our industry moves toward more green and energy efficient buildings, natural ventilation provides unique benefits to owners everywhere.

1. Lessons Learned in Controlling Naturally Ventilated Buildings
Frank Shadpour, P.E., Fellow ASHRAE, Shadpour Consulting Engineers, Inc., San Diego, CA

2. Controlling Natural Ventilation: Hospitals and Healthcare Facilities
Timothy Jacoby, Rady Children's Hospital, San Diego, CA

3. Natural Ventilation and Environmental Integration for Educational Facilities
Larry Hoeksema, Mosher Drew Watson Ferguson, San Diego, CA

Seminar 10 (Intermediate)

Seminar I: Exergy for Sustainability

Track: Exergy

Sponsor: TG1 Exergy Analysis for Sustainable Buildings (EXER)
Chair: Samuel Sami, Ph.D., Fellow ASHRAE, TransPacific Energy Inc., Carlsbad, CA

Achieving sustainable solutions for today's energy and environmental problems requires long-term planning and actions. An understanding of the thermodynamic aspects of sustainable development can help in taking sustainable actions about energy. In this regard exergy appears to be a strong tool for sustainability strategies. This seminar starts with basic aspects of rational exergy management for better sustainability and ends with rational exergy guided metrication of sustainable buildings.

1. Benchmarking with Rational Exergy Management Model to Make Buildings More Sustainable
Siir Kilkis, Student Member, TUBITAK, Ankara, Turkey

2. Low Exergy in Practice: New Energy from Old Mines
Dietrich Schmidt, Ph.D., Member, Fraunhofer-Institute for Building Physics, Kassel, Germany

3. A Continuous, Compound Metrication Function for Sustainable Buildings
Birol Kilkis, Ph.D., Fellow ASHRAE, Baskent University, Ankara, Turkey

Seminar 11 (Intermediate)

Renovating Buildings for Improved IAQ, Ventilation and Energy

Track: Indoor Air Quality

Sponsor: 4.3 Ventilation Requirements and Infiltration
Chair: William S. Dols, Ph.D., Member, National Institute of Standards and Technology, Gaithersburg, MD

There are many reasons why buildings are renovated. Regardless of the reason, designers and builders should take this opportunity to improve the various performance aspects of the building including: indoor environmental quality, ventilation and energy use. This session addresses methods of addressing these issues and associated ASHRAE standards.

1. Applying ASHRAE Standard 62.2 to Existing Buildings
Paul Francisco, Member, University of Illinois, Urbana-Champaign, IL

2. Impacts of Airtightening Retrofits on Ventilation and Energy Use in a Manufactured Home
Andrew K. Persily, Ph.D., Fellow ASHRAE, National Institute of Standards and Technology, Gaithersburg, MD

3. IAQ, Ventilation and Energy Trade-offs in Building Retrofits
Gregory M. Dobbs, Ph.D., Member, United Technologies Research Center, East Hartford, CT

4. Upgrading Central Exhaust Ventilation Systems in Multi-Family Buildings
Dianne Griffiths, P.E., Associate Member, Steven Winter Associates, Inc., Norwalk, CT

Seminar 12 (Intermediate)

Lessons Learned with Underfloor Air Distribution Systems

Track: Systems and Equipment

Sponsor: TRG7 Underfloor Air Distribution (UFAD), 9.8 Large Building Air-Conditioning Applications
Chair: Ken Loudermilk, P.E., Member, Sinclair Knight Merz, Manchester, Lancashire, United Kingdom

Since publication of ASHRAE's Guide for Underfloor Air Distribution Systems there have been many installations completed. Some of these have been very successful whilst others have had problems and required corrective attention before being accepted by occupants. This seminar provides feedback on projects which will help to ensure successful designs for future schemes. Presentations are by authors involved in an update of the ASHRAE guide to UFAD, and they welcome informed feedback from attendees.

1. Performance Results from a Large Office Building with Underfloor Air Distribution
Fred Bauman, P.E., Member, Center for the Built Environment, Berkeley, CA

2. Underfloor Air Distribution: Construction Do's, Don'ts, Tips and Tricks
Jim Megerson, P.E., Member, Christopher R. Larson, P.E., Larson Binkley Inc., Leawood, KS

3. Real World Cases Studies of UFAD Systems
Jim Vallort, Member, Environmental Systems Design Inc., Chicago, IL

4. Low Energy UFAD Design Integrating Underfloor Air Supply with Natural Ventilation
Francis A. Mills, P.E., Member, Sinclair Knight Merz, Manchester, Lancashire, United Kingdom

Seminar 13 (Intermediate)

Guideline 1.1: What's New with this New Commissioning Guideline?

Track: Applications

Sponsor: SGPC-0, 7.9 Building Commissioning
Chair: Walter Grondzik, P.E., Fellow ASHRAE, Ball State University, Muncie, IN

Four presenters provide an overview of what recently-published ASHRAE Guideline 1.1-2008, HVAC & R Technical Requirements for the Commissioning Process, has to say about activities to support the HVAC&R commissioning process during each phase of the building acquisition process -- namely pre-design, design, construction, and occupancy and operations. Emphasis will be placed on what's new in Guideline 1.1 and how it relates to ASHRAE Guideline 0, The Commissioning Process.

1. Highlights of Guideline 1.1: Pre-Design Phase
Gerald Kettler, P.E., Member, AIR Engineering and Testing, Inc., Dallas, TX

2. Highlights of Guideline 1.1: Design Phase
Joseph R. Anderson, P.E., Member, Anderson Engineering, Germantown, TN

3. Highlights of Guideline 1.1: Construction Phase
Thomas Cappellin, P.E., Member, Hanson Professional Services Inc., West Palm Beach, FL

4. Highlights of Guideline 1.1: Occupancy and Operations Phase
Tim Corbett, P.E., Member, Social Security Administration, Baltimore, MD

Seminar 14 (Intermediate)

Balancing Indoor Air Quality and Energy Conservation/Efficiency Objectives in Schools

Track: Indoor Air Quality

Sponsor: SSPC 62.1, Environmental Health Committee (EHC)
Chair: Jeffrey K. Smith, Member, Georgia Power Co., McDonough, GA

This seminar addresses two key issues that school systems are faced with on an ever increasing basis, indoor air quality and energy efficiency and the interplay between these objectives. Speakers discuss the relationships between indoor air quality and performance of students in schools. They also discuss IAQ issues in both high and low humidity conditions of schools in various climates. Additionally, energy conservation approaches in schools are discussed along with their effects upon IAQ.

1. Student Performance and Absenteeism Related to IAQ
Bud Offermann, P.E., Member, Indoor Environmental Engineering, San Francisco, CA

2. Moisture and Mold in Schools Resulting from High Humidity Conditions
Mark P. Buttner, Ph.D., Member, University of Nevada, Las Vegas, NV

3. Health Issues and Building Effects of Schools in Low Humidity Environments
Diane Green, Member, National Research Council IRC-CCC, Ottawa, ON, Canada

4. Energy Conservation and Energy Efficiency Approaches Effects on IAQ
Hoy Bohanon, P.E., Member, Working Buildings, Winston-Salem, NC

SUNDAY, 6/21 1:30 P.M.–3 P.M.

Transactions 3 (Advanced)

IEA ECBCS Annex 41 Whole Building Heat, Air, Moisture Response: A Next Step in Building Modeling

Track: Fundamentals

Sponsor: 4.4 Building Materials and Building Envelope Performance
Chair: Hugo Hens, Ph.D., Fellow ASHRAE, K.U.Leuven, Leuven, Belgium

IEA ECBCS Annex 41 took off in 2004. Main objectives were studying the physics behind whole building heat, air, moisture response, verifying and validating software tools and analyzing the effects of moisture buffering on relative humidity indoors with its consequences for comfort, health, durability and energy demand. A first paper sketches the overall annex activities and the results. The second paper digs deeper into the modeling part while the third paper looks to the material properties involved, discusses the results of a round robin on vapor permeability and sorption isotherm testing performed in the frame of the annex and analyses the validation exercises done on predicting buffering.

1. IEA-ECBCS Annex 41: Whole Building Heat, Air and Moisture Response (LO-09-007)
Hugo Hens, Ph.D., Fellow ASHRAE, K.U.Leuven, Leuven, Belgium

2. From EMPD to CFD: Overview of Different Approaches for Heat Air and Moisture Modeling in IEA Annex 41 (LO-09-008)
Carsten Rode, Ph.D., Member, Technical University of Denmark, Lyngby, Denmark

3. Reliability of Transient Heat and Moisture Modeling for Hygroscopic Buffering (LO-09-009)
Carey Simonson, Ph.D., Member, University of Saskatoon, Saskatoon, SK, Canada

Seminar 15 (Intermediate)

Reduce Your Carbon Footprint: District Energy Systems

Track: Sustainability/LEED

Sponsor: 6.2 District Energy, 1.10 Cogeneration Systems, 6.9 Thermal Storage
Chair: Frank L. St. John, P.E., Member, Applied Engineering Services, Inc., Indianapolis, IN

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 on the design of underground chilled water piping, ice storage and presents a case study of a district heating plant.

1. Design and Selection of Underground Chilled Water Systems
Bob Maffei, Member, Perma-Pipe, Inc., Niles, IL

2. District Cooling with Ice Storage
Steven Benz, Member, Evapco, Taneytown, MD

3. District Greening Saint Paul: Heating the City with Wood
Michael Burns, Member, Ever-Green Energy, LLC, Saint Paul, MN

Seminar 16 (Intermediate)

Design of Hybrid Ground Source Heat Pump Systems

Track: Applications

Sponsor: 6.8 Geothermal Energy Utilization, 6.7 Solar Energy Utilization, 9.4 Applied Heat Pump/Heat Recovery Systems
Chair: Cenk C. Yavuzturk, Ph.D., Member, University of Hartford, West Hartford, CT

Hybrid ground-coupled heat pump systems couple conventional ground-coupled heat pump equipment with supplemental heat rejection or extraction systems. In cooling- or heating-dominated climates, the use of these supplemental systems has been shown to significantly improve the economics and energy usage of the system. However, the design and operation of hybrid systems are significantly more complex than conventional ground coupled systems and there is currently relatively little information available in this regard that is accessible to the practicing engineer. This seminar presents a simulation-based tool incorporating physics-based models of the hybrid system components using a simulation program developed as a result of ASHRAE TRP-1384. Attendees will be able to sign up to become beta testers of the distributable software tool.

The Technical Program will be updated, when necessary, at www.ashrae.org/louisville

1. Development of Design Guidelines for Hybrid Ground-Coupled Heat Pump Systems (ASHRAE RP-1384), Part 1
Sanford A. Klein, Ph.D., Member, University of Wisconsin, Madison, WI; Scott P. Hackel, Student Member, Energy Center of Wisconsin, Madison, WI
2. Development of Design Guidelines for Hybrid Ground-Coupled Heat Pump Systems (ASHRAE RP-1384), Part 2
Greg F. Nellis, Ph.D., Member, University of Wisconsin, Madison, WI
3. A Case Study in Designing Hybrid Ground Source Heat Pump Systems Using ASHRAE RP-1384
Donald C. Smith, Member, Sound Geothermal, Sandy, UT

Seminar 17 (Intermediate)

Seminar II: Exergy Analysis of Building Energy Systems

Track: Exergy

Sponsor: TG1 Exergy Analysis for Sustainable Buildings (EXER)
Chair: Andreas Wagner, Ph.D., Building Science Group, University of Karlsruhe, Karlsruhe, Germany

This seminar deals with design, analysis, and performance improvement of sustainable building energy systems through exergy. The presentations include several practical examples and case studies focusing on building energy systems and applications.

1. Using Exergy to Model Central Chilled Water Systems
James Mathias, Ph.D., Southern Illinois University, Carbondale, IL
2. Exergy Analysis of Organic Rankine Cycles for Sustainable Applications
Samuel Sami, Ph.D., Fellow ASHRAE, TransPacific Energy, Inc., Carlsbad, CA
3. How to Benchmark Low-Exergy Buildings
Dietrich Schmidt, Ph.D., Member, Fraunhofer-Institute for Building Physics, Kassel, Germany
4. Exergy Management in the Design of a LEED Platinum Building
Birol Kilkis, Ph.D., Fellow ASHRAE, Baskent University, Ankara, Turkey

Seminar 18 (Intermediate)

Integrated Laboratory Designs for Improved Air Quality

Track: Indoor Air Quality

Sponsor: 9.10 Laboratory Systems, 4.3 Ventilation Requirements and Infiltration
Chair: Wade H. Conlan, P.E., Member, X-nth, Maitland, FL

Lab air quality is a life safety issue that must be addressed properly in the design and operation of a facility that extends beyond the HVAC system. Safe and energy efficient systems require an integrated approach by the engineers, lab planners, architect, lab worker and the owner. Selecting the proper fume hood, ventilated enclosure or snorkel can avoid the introduction of contaminants into the space and potentially reduce airflow and energy consumption. After properly capturing the contaminants at the source, the designer needs to make sure they are removed from the building and not reintroduced into the building air supply while ensuring the stacks and louvers are aesthetically accepted and meet ASHRAE guidelines.

1. Selecting the Proper Containment Device in Laboratories
Thomas Smith, Member, Exposure Control Technologies, Inc, Cary, NC
2. Proper Orientation of Lab Exhaust Stacks and Air Intakes
Brad Cochran, Member, CPP, Fort Collins, CO
3. Design and Operation of HVAC Systems to Improve Laboratory Air Quality
Patrick Carpenter, P.E., Member, R.G. Vanderweil Engineers, Lawrenceville, NJ

Seminar 19 (Basic)

Implementing IBC Seismic/Wind Requirements in Your State

Track: Applications

Sponsor: 2.7 Seismic and Wind Restraint Design
Chair: Robert E. Simmons, P.E., Member, The VMC Group, Houston, TX

The latest IBC has has significantly expanded the geographic boundaries where design for earthquake is required compared to past codes. The scramble to determine when an engineer, contractor or manufacturer must address seismic loads has lead to confusion. This seminar explains how to determine what the minimum requirements are in your state.

1. Understanding the Code
Richard S. Sherren, P.E., Member, Kinetics Noise Control, Dublin, OH
2. I Know Who Is Responsible
James A. Carlson, P.E., Member, Seismic Source Co., Springfield, NE
3. Project Approval
Monte G. Troutman, P.E., Member, B.C. Engineering, Inc., Evansville, IN

SUNDAY 6/21
2 P.M.–3 P.M.

Seminar 20 (Basic)

First Time at ASHRAE? This Seminar's for You!

Track: Fundamentals

Sponsor: Conferences and Expositions Committee
Chair: Ginger Scoggins, P.E., Member, Engineered Designs, 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
Ginger Scoggins, P.E., Member, Engineered Designs, Raleigh, NC
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

Monday

- Opportunities: free cooling for data centers... and challenges: telecommunications centers.
- Large building systems track begins today.
- Make your sustainable building…work!
- BIM is back—for HVAC engineers.
- Is 30% more outdoor air really better?
- Tunnel ventilation and smoke control challenges in high rise buildings.

MONDAY, 6/22
8 A.M.–9:30 A.M.

Transactions 4 (Intermediate)

Impact of New ASHRAE Research On Commercial Kitchen Environments

Track: Systems and Equipment

Sponsor: 5.10 Kitchen Ventilation, 4.7 Energy Calculations
Chair: Derek Schrock, Member, R&D, Halton Co., Scottsville, KY

This session provides an overview of the latest research findings in commercial kitchen ventilation and the impact these findings have on the industry. The first research project (1375-RP) built upon the results of previous ASHRAE project (745-RP) by measuring emissions from seven common commercial kitchen cooking appliances and associated food products. The second research project (1362-RP) tested a broad array of cooking appliances to determine the actual exhaust airflows required to capture all of the heat from the appliances for those that must be hooded along with the heat gain components that get emitted to the kitchen space. This data is included in the ASHRAE Handbooks and is invaluable for engineers designing the impact of kitchen sensible and latent loads on the HVAC system.

1. Grease Particle Emission Characterization from Seven Commercial Kitchen Cooking Appliances and Representative Food Products (RP-1375)(LO-09-010)
Thomas H. Kuehn, Ph.D., Fellow ASHRAE, University of Minnesota, Minneapolis, MN
2. Revised Heat Gain Rates from Typical Commercial Cooking Appliances from RP-1362(LO-09-011)
Richard Swierczyna, Associate Member, Architectural Energy Corp., Chicago, IL
3. Capture and Containment Ventilation Rates for Commercial Kitchen Appliances Measured during RP-1362 (LO-09-012)
Paul Sobiski, Member, Architectural Energy Corp., Chicago, IL

Transactions 5 (Intermediate)

Free Cooling Opportunities for Data Centers

Track: Applications

Sponsor: 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment
Chair: Terry L. Rodgers, Member, Syska Hennessy Group, Charlotte, NC

This transactions session will present on a variety of issues that are pertinent to strategies and technologies for providing free-cooling of data centers, telecommunications facilities, and combinations thereof. Issues of recent concern include water-side and air-side economizers, enthalpy wheels, geothermal heat sinks, climatic and geographical considerations, indoor and outdoor air quality concerns, and implementation in existing and planned data centers.

1. High Performance Computing with High Efficiency (LO-09-013)
William Tschudi, P.E., Member; Steve Greenberg, Lawrence Berkeley National Laboratory, Berkeley, CA; Amit Khanna, Arup and Partners California LLP, San Francisco, CA
2. Introducing Using the Heat Wheel to Cool the Computer Room (LO-09-014)
Robert Sullivan, Ph.D., Member, Uptime Institute, Morgan Hill, CA; Marcel Van Dijk and Mees Lodder, Uptime Technology, NL, Tuilaan, Netherlands
3. Waterside Economizing in Data Centers: Design and Control Considerations (LO-09-015)
Jeff Stein, P.E., Member, Taylor Engineering, Alameda, CA

Seminar 21 (Basic)

Introduction to Large Buildings and their Issues

Track: Large Building Systems

Sponsor: 9.8 Large Building Air-Conditioning Applications
Chair: Jeff Traylor, Member, EMCOR Government Services, Durham, NC

This program introduces the Large Building Track. Each of the cognizant TCs present their outlook and issues in regard to large and tall buildings.

1. Large Building Air-Conditioning Applications–TC 9.8
Bob Cox, Member, Jacobs, Carter & Burgess, Chapel Hill, NC
2. Tall Buildings TC 9.12
Lynn Werman, Life Member, Farris Engineering, Omaha, NE
3. Large Building Air-Conditioning Systems–TC 9.1
Dennis Wessel, P.E., Member, Karpinski Engineering, Cleveland, OH

Seminar 22 (Intermediate)

How to Make Your Sustainable Building Work

Track: Sustainability/LEED

Sponsor: 7.7 Testing and Balancing
Chair: Frank Spevak, Associate Member, The Energy Conservatory, Minneapolis, MN

Some new buildings have been constructed and have received certification of one type or another. But many times the points received for a specific design do not guarantee that the building truly is sustainable. This seminar provides various case studies on making sure that your building does work properly and will be around for many years to come.

1. Underfloor Ventilation Case Study
Gaylon Richardson, Fellow ASHRAE, Engineered Air Balance, Houston, TX
2. Controls, Settings and Verification
Gerald Kettler, Fellow ASHRAE, Air Engineering and Testing, Dallas, TX
3. Correcting the Problems Left Behind in a New Building
Andy Nolfo, Member, National Environmental Balancing Bureau, Sun City West, AZ
4. A Tale of Two Hotels
Tom Gilbertson, Member, Consulting Engineer, Moraga, CA

Seminar 23 (Intermediate)

Achieving Optimum Air Quality and Saving Energy with Air-to-Air Energy Recovery

Track: Sustainability/LEED

Sponsor: 5.5 Air-to-Air Energy Recovery
Chair: John T. Dieckmann, Member, TIAX LLC, Cambridge, MA

Supplying sufficient conditioned outdoor ventilation make-up air is essential for achieving optimum air quality in the occupied spaces of commercial buildings. Air-to-air energy recovery is an effective way to significantly reduce the energy consumed to condition outdoor make-up air. This seminar shows how to ensure that you get the performance you specify in air-to-air energy recovery. Presentations cover how to specify commission, operate and maintain air-to-air energy recovery equipment so that air quality and energy savings are achieved. A case study illustrates the execution of these basic steps and the results achieved for a building in the Louisville region.

1. Specification of Air-to-Air Energy Recovery Systems
Maury Wawryk, Member, Venmar CES, St-Leonard-d'Aston, QC, Canada
2. Commissioning, Operating and Maintaining Air-to-Air Energy Recovery Systems
Hoy Bohanon, P.E., Member, Working Buildings, Winston-Salem, NC
3. Louisville Area Case Study Illustrating the Successful Implementation of Air-to-Air Energy Recovery
Paul Pieper, Eng., PEng., Member, Venmar CES, St-Leonard-d'Aston, QC, Canada

Seminar 24 (Advanced)

Seminar III: Building High Performance with Exergy: European Perspectives

Track: Exergy

Sponsor: TG1 Exergy Analysis for Sustainable Buildings (EXER)
Chair: Tom Meyer, Member, Praxis Green, Neenah, WI

This seminar provides insight into the new high performance building technology and its implementation in Germany and Switzerland. A number of high performance buildings have been studied and monitored based on the description of the German national research program on energy-optimized buildings. This seminar presents the results of some outstanding cases including their references to low-exergy building concept. Those cases selected not only because of their high-energy efficiency, but also because of their high level of comfort, cost effectiveness, and exergy rationale. These projects offer an opportunity to obtain on-site proof, and quantifying and benchmarking markers for achieving more sustainable buildings. In addition, it highlights today's possibilities in the field of energy conservation design.

1. German Research Program "Energy Optimized Buildings:" Lessons Learned and Future Perspectives
Andreas Wagner, Ph.D., University of Karlsruhe, Karlsruhe, Germany
2. Energy Optimization in Theory and Practice: the German Office Building, Centre for Sustainable Building (ZUB)
Dietrich Schmidt, Ph.D., Member, Fraunhofer-Institute for Building Physics, Kassel, Germany
3. Monitoring of a Refurbished Print Office Building in Karlsruhe, Germany
Doreen Kalz, Ph.D., Fraunhofer-Institute for Solar Energy Systems, Freiburg, Germany
4. Performance Analysis and Evaluation of the Forum Chriesbach in Zurich, Switzerland
Thomas Frank, Empa Building Technologies, Duebendorf, Germany

Seminar 25 (Intermediate)

HVAC&R Research Seminar, Part 1: Smart HVAC&R Equipment

Track: Fundamentals

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.

The Technical Program will be updated, when necessary, at www.ashrae.org/louisville

1. Integrated Control and Fault Detection of Air-Handling Units
John M. House, Ph.D., Member, Johnson Controls, Inc., Saint Leonard, QC, Canada
2. A Smart Mixed Air Temperature Sensor
James E. Braun, Ph.D., P.E., Fellow ASHRAE, Purdue University, West Lafayette, IN
3. Development, Evaluation and Demonstration of a Virtual Refrigerant Charge Sensor
Haorong Li, Ph.D., Member, University of Nebraska-Lincoln, Omaha, NE; James E. Braun, Ph.D., P.E., Fellow ASHRAE, Purdue University, West Lafayette, IN

Seminar 26 (Basic)

Back to Basics—Compressors, Part 3

Track: Refrigeration

Sponsor: 8.1 Positive Displacement Compressors
Chair: Chris Seeton, Member, Honeywell, Buffalo, NY

Refrigeration compressors, basic compressor technology, and the application of compressors to air-conditioning and refrigeration products are addressed in this seminar, making it of interest to new engineers or engineering students. Discussion includes operational characteristics of several compressor types, compressor selection and application criteria and a review of refrigeration compressor development trends.

1. Basic Compressor Protection for Positive Displacement Compressors
Bob Utter, Member, Innovative Thermal Solutions, Adrian, MI
2. Compressors and their applications in HVAC/R systems
Alex Lifson, Member, Carrier Corp., Syracuse, NY
3. Fundamentals of Rotary Compressors
Curt Slayton, Fellow ASHRAE, Consulting Services International, Louisville, KY

MONDAY, 6/22 9:45 A.M.–10:45 A.M.

Transactions 6 (Intermediate)

Cooling of Telecom Centers

Track: Applications

Sponsor: 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment
Chair: Magnus K. Herrlin, Ph.D., Member, ANCIS Inc., San Francisco, CA

Many cooling challenges and solutions in telecommunications centers differ from those in data centers due to different physical architectures and electronic equipment characteristics. TC 9.9's activities have up to now been centered round data centers. This session addresses some specific cooling issues and trends in telecommunications centers. The first paper discusses the convergence of telecommunications centers and data centers whereas the second paper addresses the barriers to deploying liquid cooling in telecommunications environments.

1. Convergence of Telecommunications and Data Centers (LO-09-017)
David Quirk, P.E., Member, Verizon Wireless, Basking Ridge, NJ
2. Hurdles in Deploying Liquid Cooling in NEBS Environments (LO-09-018)
Herman Chu, Cisco Systems, Inc., San Jose, CA

Transactions 7 (Basic)

Comparison of Tunnel Ventilation Simulation and Field Tests

Track: Applications

Sponsor: 5.9 Enclosed Vehicular Facilities, 5.6 Control of Fire and Smoke
Chair: George Hadjisophocleous, Ph.D., PEng., Member, Carleton University, Ottawa, ON, Canada

Computer models such as computational fluid dynamics models are used to design ventilation systems for tunnels. It is important that these models are validated by comparing their predictions with experimental data. This session presents results of studies performed to compare field test data with results of computer simulations.

1. Comparisons of Numerical Predictions and Field Tests in a Road Tunnel (LO-09-019)
Ahmed Kashef, Ph.D., Member, National Research Council, Ottawa, ON, Canada
2. CFD Study of Smoke Movement during the Early Stage of Tunnel Fires: Comparison with Field Tests (LO-09-020)
Yoon Ko, Carleton University, Ottawa, ON, Canada

Seminar 27 (Intermediate)

Energy Modeling for Large Building Systems

Track: Large Building Systems

Sponsor: 4.7 Energy Calculations
Chair: Timothy P. McDowell, Member, Thermal Energy System Specialists, LLC, Madison, WI

Large building systems provide many challenges and difficulties for energy modelers. The speakers discuss how they have approached these challenges in successfully modeling these types of large HVAC systems.

1. Applying ASHRAE 90.1: Energy Efficiency of High Rise Buildings in Germany
Oliver Baumann, Associate Member; Claudius Reiser, Ebert & Baumann Consulting Engineers, Inc., Washington, DC
2. Energy Analysis of HVAC System Alternatives for a High Rise Multi-Family Residential Building in Denver
Aleka Pappas, Member, Enermodal Engineering Inc, Denver, CO

Seminar 28 (Intermediate)

Real World BIM for the HVAC Engineer

Track: Applications

Sponsor: BIM Steering Committee, 1.5 Computer Applications
Chair: Krishnan Gowri, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA

This seminar addresses how an HVAC engineer can work with the architect to develop BIMs that can be used for better energy analysis and HVAC system design and provide case studies of real projects examples that are being produced in today's markets.

1. How to Set Up a BIM to Optimize Energy Analysis and HVAC System Design
Dennis Knight, P.E., Member, Liollio Architecture, Charleston, SC
2. HVAC Design and Energy Analysis Case Studies using BIM as the Basic Design Tool
Duane Barrett, Bentley Systems Inc., Baltimore, MD

Seminar 29 (Intermediate)

HVAC&R Research Seminar, Part 2: Energy Recovery

Track: Fundamentals

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. Run-Around Energy Recovery System for Air-to-air Applications Using Cross-flow Exchangers Coupled with a Porous Solid Desiccant Part 1: Model Development and Verification
Wei Shang, Ph.D., Member, University of Saskatchewan, Saskatoon, SK, Canada
2. Run-Around Energy Recovery System for Air-to-air Applications Using Cross-flow Exchangers Coupled with a Porous Solid Desiccant Part 2: Results and Performance Sensitivity
Wei Shang, Ph.D., Member, University of Saskatchewan, Saskatoon, SK, Canada

Forum 1 (Intermediate)

Can CHP Systems Maintain their Sustainability Advantage or Is Operations and Maintenance Too Difficult?

Track: Applications

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 being designed to be modular and integrated. The developers of these systems believe their time has come. Everybody is talking about their carbon footprint where CHP provides an economically viable solution. There are few economically viable methods to achieve zero net energy buildings without considering CHP as part of the energy equation. Data centers are considering CHP because stable coincident terminal cooling and power loads and the need for high reliability. But, are these power and thermal systems ready for primetime? The participants in this forum discuss their current experience with CHP operations and maintenance; discuss the need for guidelines and develop ideas for improvement.

Forum 2 (Intermediate)

What Is Missing in High Performance Building Definition?

Track: Exergy

Sponsor: TG1 Exergy Analysis for Sustainable Buildings (EXER)
Chair: Peter Novak, Ph.D., Fellow ASHRAE, School of Technologies and Systems, Ljublijana, Serbia

This forum is designed for high performance building enthusiasts and will let them explore the benefits of exergy management for furthering the performance of sustainable buildings.

Forum 3 (Intermediate)

Is 30% More Outdoor Air Really Better?

Track: Indoor Air Quality

Sponsor: SSPC 62.1
Chair: Hoy Bohanon, P.E., Member, Working Buildings, Winston-Salem, NC

Recent proposed standards have suggested that providing 30% more outdoor air may improve air quality. Is this really the case? Is more air better? How much more? What about outdoor pollutants? What about energy? What about studies correlating improved performance to more outdoor air? Come to this forum and let your opinion be heard.

MONDAY, 6/22 11 A.M.–12 P.M.

Transactions 8 (Advanced)

Advanced Refrigeration System and Open Front Supermarket Display Case Component Technologies

Track: Refrigeration

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

This session includes two papers. The first paper describes research on a novel implementation of an Ericsson cycle heat pump for near ambient refrigeration duty and assessment of its viability for vending machine applications. The second presents results of a project to develop improved technology for open vertical supermarket display case air curtains.

1. Evaluation of a Novel Liquid-Flooded Ericsson Cycle Cooler for Vending Machine Applications (LO-09-021)
Jason Hugenroth, Ph.D., P.E., Associate Member, Oak Ridge National Laboratory, Oak Ridge, TN; James Braun, Ph.D., Fellow ASHRAE, ; Eckhard Groll, Ph.D., Fellow ASHRAE and Galen King, Ph.D., Purdue University, West Lafayette, IN
2. Experimental Investigation of the Effect of Various Parameters on the Infiltration Rate of Single Band Open Vertical Refrigerated Display Cases with Zero Back Panel Flow (LO-09-022)
Mayzar Amin, Student Member, Oak Ridge National Laboratory, Oak Ridge, TN; Dana Dabiri, Ph.D.,University of Washington, Seattle, WA ; Homayun K. Navaz, Ph.D., Member, Kettering University, Flint, MI

Transactions 9 (Intermediate)

Smoke Control Challenges in High-Rise Buildings

Track: Large Building Systems

Sponsor: 5.6 Control of Fire and Smoke, 5.9 Enclosed Vehicular Facilities
Chair: Ahmed Kashef, Ph.D., P.Eng., Member, National Research Council Canada, Ottawa, ON, Canada

This session addresses the issues related to control smoke in high-rise buildings. Emergency smoke control systems within high-rise buildings use pressurization and air movement to contain and remove smoke and improve life safety. The implications of using different approaches to smoke control on evacuation, fire fighting, and cost are illustrated. Wind can be a hindrance to the smoke control systems in several ways. Wind can exert pressures on building openings causing the reduction of airflow control effectiveness. For smoke control systems that use natural ventilation for exhaust or makeup air, wind pressures may seriously disrupt the system. The session presents several case studies that illustrate the potential issues and ways of reducing wind effects and methods of increasing life safety in high-rise buildings.

1. Wind Effects on Smoke Control (LO-09-023)
Ray Sinclair, Ph.D., P.Eng., Member, RWDI, Guelph, ON, Canada
2. Pressurization of Floors to Improve Life Safety during a High-rise Fire (LO-09-24)
William Black, Ph.D., Member, Georgia Institute of Technology, Atlanta, GA

Seminar 30 (Intermediate)

Use of Liquid Desiccants for Improved Air Quality and Ventilation Air Energy Savings

Track: Exergy

Sponsor: 8.12 Desiccant Dehumidification Equipment and Components
Chair: Stan Slabinski, Member, Kathabar Dehumidification Systems Div. of Niagara Blower Co., Somerset, NJ

With the rising prices and decreased reliability of electricity, building owners are evaluating cost-effective means to satisfy the stricter IAQ standards demanded by the government and industry. Due to the need for increased outside air, owners are realizing that traditional building air conditioning, which typically uses cooling coils with refrigeration for cooling, is an expensive process. There is potential for significant ventilation system energy savings by incorporating a liquid desiccant type building energy reduction system. With an integrated systems approach, these systems efficiently use waste heat and also support on-site power generation and co-generation. This technology can be applied to office buildings, research facilities, laboratories, bio-tech facilities, microelectronics manufacturing, pharmaceutical and manufacturing.

1. Ventilation Energy Savings and Increased Air Quality with Liquid Desiccant Dehumidification
Michael Harvey, Kathabar Dehumidification Systems Div. of Niagara Blower Co., Buffalo, NY
2. Novel Liquid-Desiccant Conditioner for DOAS Applications
Andrew I. Lowenstein, Ph.D., Member, AIL Research, Inc., Princeton, NJ

Seminar 31 (Advanced)

Contracts?? (Ugh! Boring!) A Comparison of the AIA 2007 and AGC ConsensusDocs Contract Forms

Track: Business Management

Sponsor: 1.7 Business, Management & General Legal Education, 7.1 Integrated Building Design
Chair: Mitchell Swann, PE, Member, MDC Systems LLC, Paoli, PA

Contracts can be a dry, dull subject filled with boring language and arcane phrases. But the old adage of the pen being mightier than the sword is proven again and again in the little twists and turns of your contract. You must be careful how you cut it because sloppy drafting can cause you to cut off your own ear. The AIA 2007 series has quite a few new wrinkles that warrant your attention. The upstart AGC ConsensusDocs are gaining ground especially in BIM and IPD projects. This program highlights key elements of each, compare language and discuss the implications to designers, owners and contractors.

1. New and Improved: It's the AIA 2007!!
Stephen T. Del Percio, Esq., J.D., Arent Fox LLP, New York, NY
2. Watch Out!It's the New Kid on the Block–The AGC ConsensusDocs!
Anne E. Gorham, Esq., J.D., Stites & Harbison PLLC, Lexington, KY

Forum 4 (Intermediate)

To LEED or Not to LEED: What Are the IAQ and Energy Implications?

Track: Indoor Air Quality

Sponsor: 2.3 Gaseous Air Contaminants and Gas Contaminant Removal Equipment
Chair: Christopher O. Muller, Member, Purafil, Inc., Doraville, GA

With so many commercial buildings and schools trying to achieve LEED certification, many are beginning to question whether the stated goals of making "a positive impact on public health and the environment, and reducing operating costs" may be mutually exclusive

based on the requirements for determining the outdoor air ventilation rates. By restricting the design of the mechanical ventilation systems to be as per the Ventilation Rate Procedure described in ASHRAE Standard 62.1-2007 (or more stringent local codes), one may not realize the implied goals of improving the indoor environment or energy conservation. The implications of EQ (Environmental Quality) Prerequisite 1: Minimum IAQ Performance Required and EQ Credit 2: Increased Ventilation on indoor air quality and building operating costs will be explored.

Forum 5 (Basic)

Are You Ready for HACCP?: Management, Operations and Financial Implications of a Legionnaires Disease Hazard Analysis?

Track: Operational Topics

Sponsor: SPC188P, 3.6 Water Treatment
Chair: Michael P. Patton, Member, Dolphin WaterCare Divsion of Clearwater Systems Corp., Essex, CT

For a number of years, Hazard Analysis and Critical Control Point (HACCP) plans have been utilized in the food industry to reduce transmission of infectious organisms from food to humans. Because of the success of HACCP in that industry, SPC 188P, Prevention of Legionellosis Associated with Building Water Systems, may choose to adopt HACCP as a systematic disease prevention strategy for legionellosis. Any HACCP plan will necessitate certain responsibilities on building owners and operators which will affect the operation of their buildings. This forum explores the potential managerial, operational and financial implications that a HACCP plan may engender, and provide further guidance to SPC 188 in its development of this standard.

Forum 6 (Intermediate)

O&M Training for HVAC&R Cx: What Should Be Included in Guideline 1.3?

Track: Operational Topics

Sponsor: GPC 1.3
Chair: Sarah E. Maston, P.E., Member, RDK Engineers, Andover, MA

As the outline for Guideline 1.3, Building Operation and Maintenance Training for the HVAC&R Commissioning Process, is being written, the GPC seeks comments from the membership. The purpose of the guideline is to provide methodologies and formats for developing training plans, conducting training programs, and documenting training results for the operation and maintenance of building HVAC&R systems during the commissioning process.

Forum 7 (Basic)

What Should an ASHRAE Standard on Water Conservation Include?

Track: Sustainability/LEED

Sponsor: SPC 191, 3.6 Water Treatment
Chair: Scott E. Mayes, Member, Scott's Square Deal, Olathe, KS

Because water is becoming an ever more precious resource means of conserving water have become increasingly important. In response to this need, ASHRAE and the AWWA are drafting a standard on water conservation. This forum gives attendees an opportunity to voice their opinions on what the new standard should include and how broad the scope should be.

TC Meeting Session

TC 9.9, Mission Critical Facilities, Technology Spaces and Electronic Equipment: DOE Certified Energy Practitioner (CEP) Program for Data Centers.

Monday, June 22, 2 – 3 p.m.

Tuesday

- **Cost impacts of ASHRAE's new IAQ guide.**
- **HVAC applications sessions: cleanrooms, indoor sports facilities, entertainment venues.**
- **Laboratory exhaust and design sessions**
- **Fans' contributions to achieving Standard 90.1.**
- **Live debate: are cities sustainable?**
- **Buildings update: the first 100 days.**
- **Meet the authors: 40 papers are presented in the one-on-one, Q&A discussion-format poster session.**

TUESDAY, 6/23
8 A.M. – 9:30 A.M.

Transactions 10 (Intermediate)

Cleanroom Energy Consumption and Humidification

Track: Applications

Sponsor: 9.11 Clean Spaces
Chair: Wei Sun, P.E., Member, Engsysco, Inc., Ann Arbor, MI

Energy consumption is typically much higher in cleanroom facilities than general-purpose buildings, the new criterion called Specific Energy Consumption (SEC) provides a less-bias comparison methodology of energy usage. The author benchmarked SEC values collected from many semiconductor and electronics fabrication facilities, and further proposed innovative energy efficient design approaches in ventilation system to save energy consumption. Another author addressed various humidification approaches for large-scale cleanrooms, and found out that relative humidity (RH) distribution and time-based RH variation in the cleanrooms can be controlled within a small tolerance by using direction humidification in return chase with high-pressure water atomization through spray nozzles, this methodology utilized less energy than other conventional humidification approaches.

1. Specific Energy Consumption (SEC) for Integrated Circuit Assembly and Testing (LCA/T) Industry in Taiwan (LO-09-025)
Shih-Cheng Hu, Ph.D., Member; Andy Chang, National Taipei University of Technology, Taipei, Taiwan; D. Chan, Ph.D.; R. Hsu, Industrial Technology Research Institute, Hinchu, Taiwan; Tim Xu, Ph.D., P.E., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

2. Humidify Large-Scale Cleanrooms by Adiabatic Humidification Method in Subtropical Areas (LO-09-026)
Jacky Chen, P.E., Daxin Materials Corp., Hinchu, Taiwan; James Tsao, Ph.D., PECL Co. U.S.A, Hinchu, Taiwan; James Hwang, Ph.D., Taiwan Semiconductor Manufacture Co., Hinchu, Taiwan; T. Lin; Shih-Cheng Hu, Ph.D., Member, National Taipei University of Technology, Taipei, Taiwan

Transactions 11 (Intermediate)

Ventilation and Comfort Performance of Stratified Air Distribution Systems

Track: Indoor Air Quality

Sponsor: 5.3 Room Air Distribution
Chair: Fred S. Bauman, P.E., Member, University of California, Berkeley, CA

It has long been recognized that stratified air distribution systems, such as displacement ventilation (DV) and underfloor air distribution (UFAD) have the potential to provide improved ventilation performance compared to conventional (mixing) air distribution systems. This session features RP-1373, in which air distribution effectiveness (based on experiments and CFD modeling) was investigated as a function of key design parameters. Field measurements of two Canadian buildings (DV and UFAD) and design calculations for a Chinese gymnasium are also presented.

1. Comparison of Airflow and Contaminant Distributions in Rooms with Traditional Displacement Ventilation and Underfloor Air Distribution Systems (RP-1373)(LO-09-028)
Kisup Lee, Student Member; Tengfei Zhang, Ph.D., Purdue University, West Lafayette, IN; Zheng Jiang, Ph.D., Member, Building Energy and Environment Engineering, Lafayette, IN; Qingyan Chen, Ph.D., P.E., Fellow ASHRAE, Purdue University, West Lafayette, IN

2. Air Distribution Effectiveness with Stratified Air Distribution Systems (RP-1373)(LO-09-029)
Kisup Lee, Student Member, Purdue University, West Lafayette, IN

3. In-situ Performance of Stratified Air Distribution Systems in Two Canadian Buildings (LO-09-030)
Boualem Ouazia, Member; Marianne Bérubé Dufour; Dominique Derome; Michel Tardif, Member; Radu Zmeureanu; André Potvin; Silvestre Celis-Mercier, National Research Council Canada, Ottawa, ON, Canada

4. Distribution in Large Space Building with Stratified Air Conditioning System(LO-09-031)
Huang Chen, Ph.D., Member and Xin Wang, Ph.D., University of Shanghai for Science and Technology, Shanghai, China

Seminar 32 (Intermediate)

Design and Case Studies for Indoor Sports Facilities

Track: Large Building Systems

Sponsor: 9.1 Large Building Air-Conditioning Systems
Chair: Phillip Trafton, Member, Dickerson Associates, Van Nuys, CA

This session explores design issues and review case studies for three indoor sports facilities. New venues and renovations of existing buildings are covered. Speakers address energy, indoor comfort and challenges faced. Enclosed basketball and football arenas are discussed.

1. Case Study of New College Basketball Arena
Stephen W. Duda, P.E., Member, Ross and Baruzzini, St. Louis, MO

2. History and Lessons Learned on Design for Enclosed Football Stadiums
Robert Towell, P.E., Member, CxE Group LLC, St. Louis, MO

3. Historical Progression of HVAC Systems and Renovations of a College Basketball Arena
Kelley Cramm, P.E., Member, Henderson Engineers, Lenexa, KS

Seminar 33 (Intermediate)

Current and Future Options for Simulation of Refrigerated Facilities

Track: Refrigeration

Sponsor: 10.1 Custom Engineered Refrigeration Systems, 10.8 Refrigeration Load Calculations
Chair: Todd Jekel, Dr.Eng., P.Eng., Member, IRC, U.W. Madison, Madison, WI

Only recently have building simulation programs started to tackle the task of simulating load and energy consumption of refrigerated storage facilities. Government and owners realize the large amounts of energy these facilities consume and are eager to find opportunities to reduce this cost. Two software packages, DOE 2.2R and Energy+, are both developing refrigeration components to tackle this problem. This seminar introduces these programs to the audience and show an example of what is currently possible.

1. The Future Direction of Energy+ in Modeling Refrigerated Warehouses
Therese Stovall, Member, Oak Ridge National Laboratory, Oak Ridge, TN

2. DOE 2.2R (eQuest) and Its Refrigeration Modeling Capabilities
Steve Gates, P.E., Affiliate, James J. Hirsch & Associates, Gold River, CA

3. Lessons Learned from 15 years of Refrigerated Facility Simulation
Doug Scott, Member, VaCom Technologies, La Verne, CA

Seminar 34 (Intermediate)

Good Design Decisions in Exhaust Air Cleaning

Track: Systems and Equipment

Sponsor: 5.4 Industrial Process Air Cleaning (Air Pollution Control), 5.8 Industrial Ventilation Systems
Chair: So-Yeng Chen, Member, Dalton USA, Los Angeles, CA

Ideally you want your lab exhaust to be as clean as possible. Now the ante has gone up, and it should be as carbon and energy neutral as possible as well. What do you get for the extra work you put into cleaning your exhaust? Find out from this seminar with presentations on theory and practical applications.

1. Laboratory Exhaust Gas Cleaning Devices: What Are They and What Are the Problems?
Shinji Sunohara, P.E., Member, Dalton Corp., Fujieda-shi, Shizuoka-ken, Japan

2. Good Design Decision in Exhaust Air Cleaning
Wayne Lawton, P.E., Life Member, Merrick and Co., Aurora, CO

3. Laboratory Exhaust: Is Its Quality (Odor, Fumes, Particulates and Color) Acceptable to Your Neighbors?
Rajendera Kapoor, P.E., Member, Dalton Corp., Tokyo, Japan

Seminar 35 (Intermediate)

Modeling Techniques for Personal Ventilation

Track: Indoor Air Quality

Sponsor: 4.10 Indoor Environmental Modeling
Chair: H. Ezzat Khalifa, Ph.D., Member, Syracuse University, Syracuse, NY

Personalized ventilation systems (PV) have been shown to provide much higher breathing zone air quality at lower energy consumption, and to enhance human comfort, perception of air quality and productivity. In most PV systems, air is introduced by one or more nozzles or air terminal devices (ATDs) placed in the vicinity of the person. The jets produced by these devices interact not only with the human thermal plume and breathing but also with the flow fields induced by general ventilation systems, creating a much more complex flow, temperature and concentration fields with much steeper gradients around the person than conventional mixing or displacement ventilation systems.

1. Influence of Chemical Interactions at the Human Surface on Breathing-Zone Levels of Ozone and Ozone Reaction Products
Atila Novoselac, Ph.D., Member, University of Texas, Austin, TX

2. An Optimized PV System: Can It Achieve All?
John Zhai, Ph.D., Member, University of Colorado, Boulder, CO

3. Computational Modeling of the Personal Micro-Environment with and without Personal Ventilation
Jackie Russo, Syracuse University, Syracuse, NY

4. A Simplified Approach to Describe Complex Diffusers in Displacement Ventilation for CFD Simulations
Qingyan Chen, Ph.D., Fellow ASHRAE, Purdue University, W. Lafayette, IN

Seminar 36 (Intermediate)

Successes and Challenges of Sustainable Building Metrics Implementation

Track: Sustainability/LEED

Sponsor: TRG4 Sustainable Building Guidance and Metrics (SBGM), TG1 Exergy Analysis for Sustainable Buildings (EXER)
Chair: Pat Graef, P.E., Member, Munters Corp., Fort Myers, FL

Metrics and the ability to measure and track building performance are integral to successful design, construction and operation of green and sustainable buildings. Experience, evolution and emergence of available metrics and methods to track and measure building performance over the last decade have resulted in many successes and challenges. This seminar discusses metrics based on exergy and carbon emissions, interactions between water and energy, practical results of a recent survey of professionals regarding the challenges of measuring and tracking building energy performance, and opportunities for developing sustainable construction metrics.

1. Understanding Exergy Aspects of Energy and Carbon Emissions
Birol I. Kilkis, Ph.D., Member, Baskent University, Ankara, Turkey

2. Interactions and Applications of Water and Energy
H. Jay Enck, Member, Commissioning & Green Building Solutions, Inc., Buford, GA

3. Understanding the Challenges of Documenting Building Performance
Angela Lewis, Student Member, Penn State University, University Park, PA
4. Opportunities in Developing Metrics for Construction
Filza H. Walters, Member, Wayne State University, Detroit, MI

Seminar 37 (Intermediate)

Cost Impacts of ASHRAE's New IAQ Guide

Track: Indoor Air Quality

Sponsor: 7.8 Owning and Operating Costs, 7.3 Operation and Maintenance Management
Chair: Jim Earley, Georgia Power Co., Atlanta, GA

Implementing standards to improve IAQ may also impact the revenue stream. Do the practices have a cost burden or a return on the investment? This seminar presents data on the cost/benefit of implementing Standard 180, "Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems," "SMACNA's IAQ Guidelines for Occupied Buildings Under Construction" and Tuning HVAC Control Loops. Theory and case information are presented in support of field findings and experience.

1. Is There a Cost Impact of Implementing Standard 180?
Charles E. Dale-Derks, P.E., Member, McClure Engineering, St. Louis, MO
2. What Is the Cost Impact of SMACNA's IAQ Guidelines for Occupied Buildings Under Construction
Eli Howard, III, P.E., Affiliate, SMACNA, Chantilly, VA
3. What Is the Financial Impact of Retuning Control Loops
Eric Utterson, P.E., Associate Member, McClure Engineering, St. Louis, MO

TUESDAY, 6/23
9:45 A.M.–10:45 A.M.

Transactions 12 (Intermediate)

Proper OA Design Criteria for Sustainable Design and Efficiency

Track: Systems and Equipment

Sponsor: 8.10 Mechanical Dehumidification Equipment and Heat Pipes
Chair: Tim Sechrist, Associate Member, Poolpak Technologies, York, PA

TC 8.10 began the process of addressing the needs for a dedicated outside air design guide with a forum at the 2007 Long Beach annual meeting. The overwhelming enthusiasm for such a design guide led the TC to sponsor a seminar at the 2008 winter meeting. This session continues that objective with special emphasis on the Society's theme of sustainable design. The first speaker presents "Contaminate Transport Issues with DOAS" and the second speaker addresses "Safety Factors in the Design of DOAS."

1. Contaminate Transport and Filtration Issues with Dedicated Outdoor Air Systems (DOAS)(LO-09-032)
Stanley A. Mumma, Ph.D., P.E., Fellow ASHRAE, Penn State University, Bellefonte, PA
2. Role of Safety Factors in the Design of Dedicated Outdoor Air Systems (DOAS) (LO-09-033)
John Murphy, Member, Trane, LaCrosse, WI

Transactions 13 (Advanced)

Heat Gain from Electrical Equipment

Track: Applications

Sponsor: 9.2 Industrial Air Conditioning
Chair: Deep Ghosh, Southern Co., Birmingham, AL

HVAC designers currently uses electrical equipment heat loads from existing technical papers which are based on conservative assumptions. ASHRAE Research project RP 1395 was established to investigate and optimize the heat loads from various electrical equipments. This session presents the heat load contributions from the components in medium and low voltage switchgears. The results of these papers will be included in an ASHRAE Design Guide.

1. Building Heat Load Contributions from Medium and Low Voltage Switchgear, Part 1: Solid Rectangular Bus Bar Heat Losses (RP-1395)(LO-09-034)
Warren N. White, Ph.D., Kansas State University, Manhattan, KS
2. Building Heat Load Contributions from Medium and Low Voltage Switchgear, Part 2: Component and Overall Switchgear Heat Gains (RP-1395) (LO-09-35)
E. C. Piesciorovsky, Kansas State University, Manhattan, KS

Seminar 38 (Intermediate)

Design For Hazardous Exhaust Conditions

Track: Systems and Equipment

Sponsor: TC 9.10 Laboratory Systems and TC 5.4 Industrial Process Air Cleaning, 5.4 Industrial Process Air Cleaning (Air Pollution Control), 9.10 Laboratory Systems
Chair: Wayne M. Lawton, P.E., Member, Merrick, Aurora, CO

Hazardous exhaust systems are critical to providing safety for users, the environment and to provide for energy efficiency. Improperly designed safety and energy efficiency may be less than optimal, properly done safety and energy efficiency can be optimized.

1. The Decision-Making Process in Designing Laboratory Exhaust Systems under IMC 510
J. Patrick Carpenter, P.E., Member, Vanderweil, Lawrenceville, NJ
2. The Decision Making Process in Designing Safe and Efficient Industrial Ventilation Systems for Hazardous Exhaust Steams
Wayne Lawton, P.E., Member, Merrick, Aurora, CO

Seminar 39 (Intermediate)

Defining the Contribution of Fans in Achieving the Goals of ASHRAE Standard 90.1

Track: Systems and Equipment

Sponsor: 5.1 Fans, 5.9 Enclosed Vehicular Facilities
Chair: Asesh Raychaudhuri, P.E., Member, US Dept. of Veterans Affairs, Washington, DC

The goal of the revision to ASHRAE 90.1 is to include component selection techniques and fan energy efficiency. Power consumption reduction by 30% requires careful consideration related to tradeoffs between first cost and power consumption together with creating choice flexibility for the system designer. Improvement in fan efficiency and selection techniques is discussed to assure adequate net power savings.

1. How to Achieve Energy Savings in the Operation of Fans while Maintaining Flexibility
John Cermak, Ph.D., Member, ACME Engineering & Manufacturing Corp., Tulsa, OK
2. Selecting and Operating Fans in HVAC Systems for Energy Saving
John Murphy, Ph.D., Member, Jogram Inc, New Philadelphia, OH

Forum 8 (Intermediate)

What New Topics Should be Added to Handbook Chapter 26 on Mechanical Insulation?

Track: Fundamentals

Sponsor: 1.8 Mechanical Systems Insulation
Chair: Christopher P. Crall, P.E., Member, CCrall Consulting, Gahanna, OH

Chapter 26 of the *ASHRAE Handbook—Fundamentals* volume, covers insulation for mechanical systems (pipe, ducts, tanks, and equipment). This chapter was first published in the 2005 Handbook. In preparation for revising the chapter, TC 1.8 requests input on topics that should be included in future versions. Currently under consideration is the possible inclusion of several simple calculation tools for the CD+ version. Input from designers of mechanical systems for commercial and industrial facilities is especially desired.

Forum 9 (Intermediate)

What Is Needed for the Advancement of Refrigeration Computer Simulation?

Track: Refrigeration

Sponsor: 10.8 Refrigeration Load Calculations
Chair: Michele Friedrich, PE, Member, Pacific Gas and Electric Co., San Francisco, CA

The movement towards net zero energy buildings, green and sustainable design and the development of walk-in cooler/freezer and refrigerated warehouse energy efficiency codes and standards creates a demand for computer simulations that model refrigeration loads, optimize size and control of HVAC and refrigeration system in same building, simulate refrigeration systems and controls, heat recovery for use in building heating and the interactions of refrigerated spaces with unrefrigerated spaces and HVAC systems, preferably all in the same tool. But is this currently possible using existing software? If not, what advancements are needed? Share your needs for modeling refrigeration loads and systems and solutions for developing the simulation tools.

Forum 10 (Basic)

Variable Refrigerant Flow (VRF) Handbook Chapter Forum

Track: Systems and Equipment

Sponsor: TG8 Variable Refrigerant Flow (VRF)
Chair: Paul Doppel, Member, Mitsubishi Electric, Suwanee, GA

Variable Refrigerant Flow (VRF) technology has been in the United States for many years, but a comprehensive definition and explanation on the unique qualities inherent in these systems has yet to be included the ASHRAE Handbook. At this forum, a draft of the Variable Refrigerant Flow chapter will be presented. Discussed are general VRF system specifications, and what information, if any, is missing from the chapter and must be added before final publication.

Forum 11 (Intermediate)

Design Issues for Large Building Applications

Track: Large Building Systems

Sponsor: 9.8 Large Building Air-Conditioning Applications, 9.1 Large Building Air-Conditioning Systems
Chair: Robert L. Cox, P.E., Member, Jacobs Engineering, Cary, NC

This program serves as a summary wrap up of the design issues discussed in several previous presentations in the Large Building Systems and Applications Program Track. Speakers from the previous sessions will be available for a panel discussion to review current Design Issues and future design concepts to achieve sustainable large buildings in the future.

TUESDAY, 6/23
11 A.M.–12:30 P.M.

Transactions 14 (Intermediate)

Modeling and Control of the Microenvironment Around Human Body

Track: Indoor Air Quality

Sponsor: 4.10 Indoor Environmental Modeling
Chair: Qingyan Chen, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN

Microenvironment around a human body is crucial for providing acceptable thermal comfort and indoor air quality. The papers in this session discuss how different strategies could be used in ventilation or airflow systems to control and evaluate the microenvironment.

1. Performance Evaluation of Ceiling Mounted Personalized Ventilation System (LO-09-036)
Bin Yang, Student Member, National University of Singapore, Singapore
2. Modeling of the Human Body to Study the Personal Micro Environment (LO-09-037)
Ryan K. Dygert, Syracuse University, Syracuse, NY
3. Improved Performance of Personalized Ventilation by Control of the Convection Flow Around Occupant Body (LO-09-038)
Zhecho D. Bolashikov, Danish Technical University, Lyngby, Denmark

Transactions 15 (Intermediate)

Inlet Installation Effects on Air and Sound for Propeller Fans

Track: Applications

Sponsor: 5.1 Fans, 5.9 Enclosed Vehicular Facilities
Chair: Asesh Raychaudhuri, P.E., Member, US Dept. of Veterans Affairs, Washington, DC

This transactions session is based on the research project RP-1223 work and the corresponding results. Fan performance data measured on as installed condition shows different performance compared to manufacturer's published data primarily due to different inlet/outlet connections of "in the field" installation. The air and sound performance of propeller fans were measured with systematic variation of inlet flow components with simulated "in the field" installation.

1. Test Apparatus and Procedure to Measure Inlet Installation Effects of Propeller Fans (RP-1223) (LO-09-039)
Mathew N. Young, Ph.D., Affiliate, TVA/Bechtel, Knoxville, TN
2. Aerodynamic Performance and System Effects of Propeller Fans with Different Inlet Configuration (RP-1223)(LO-09-040)
Stephen Idem, Ph.D., Member, Tennessee Tech University, Cookeville, TN
3. Acoustic System Effects of Propeller Fans with Different Inlet Configurations (RP-1223)(LO-09-041)
Corinne Darvennes, Ph.D., Affiliate, Tennessee Tech University, Cookeville, TN

Seminar 40 (Intermediate)

Design Challenges and Solutions for Entertainment Venues

Track: Large Building Systems

Sponsor: 9.1 Large Building Air-Conditioning Systems
Chair: Lee Millies, Jr., P.E., Member, R.L. Millies & Associates, Munster, IN

This program discusses the unique challenges associated with large entertainment venues. These challenges include strategies for part load, maintaining indoor comfort with varying occupancies and strict acoustic criteria.

1. Large Movie Theater Complex Design Challenges
John Kuempel, P.E., Member, Debra-Kuempel, Cincinnati, OH
2. Mechanical Systems for a New World Class Performing Arts Center
Stuart Branden, P.E., Member, W.L. Cassell Associates, Kansas City, MO
3. How to Design Multi-use Outdoor NFL Football Facilities
Howard McKew, P.E., Member, Richard D. Kimball Co., Andover, MA

Seminar 41 (Intermediate)

Challenge of Grease, Smoke and Odor Control from Commercial Cooking

Track: Systems and Equipment

Sponsor: 5.10 Kitchen Ventilation
Chair: Donald R. Fisher, P.Eng., Associate Member, Fisher-Nickel, inc., San Ramon, CA

The grease laden effluent from commercial cooking equipment challenges the design of a kitchen ventilation system from its capture within the hood to its discharge into the environment. ASHRAE research has helped to characterize this effluent, providing the industry with knowledge that can help develop better grease extraction and control equipment. Effective grease removal reduces loading in the ductwork and adverse effects on the environment. This seminar candidly explores design solutions and strategies to mitigate the impact of grease particles, vapor and odors.

1. Role of Hood Filters in Grease, Smoke and Odor Control
Michael Morgan, Associate Member, Captive Aire Systems, Allentown, PA
2. Smoke and Odor Control: The Challenge to the Designer
Robert Ajemian, Associate Member, Green Kitchen Designs, New York, NY
3. Role of UV in Commercial Kitchen Exhaust Systems
Russell Robinson, Life Member, Gaylord Industries, Tualatin, OR
4. Solving Grease and Odor Problems from Restaurants
John A. Clark, Member, Karges-Faulconbridge, Inc, Minneapolis, MN

Seminar 42 (Basic)

Cities Are Not Sustainable: A Debate

Track: Sustainability/LEED

Sponsor: College of Fellows
Chair: Charles Culp, Ph.D., P.E., Fellow ASHRAE, Texas A&M University, College Station, TX

The College of Fellows introduces a new type of program—a debate. The first debate discusses the sustainability of cities. One group of ASHRAE Fellows debate with an opposing group of ASHRAE Fellows on the above topic.

Sustainability of Cities: Pro and Con
Bill Coad, P.E., Presidential Fellow Life Member, Coad Engineering Enterprises, St. Louis, MO; Richard Hayter, Ph.D., P.E., Presidential Fellow Life Member, Kansas State University, Manhattan, KS; Richard Rooley, Presidential/Fellow/Life Member, Rooley Consultants, Stoke Poges, Bucks, United Kingdom; Larry Spielvogel, P.E., Fellow/Life Member, Consulting Engineer, King of Prussia, PA; Terry Townsend,

Presidential/Fellow/Life Member, Townsend Engineering, Chattanooga, TN

Seminar 43 (Basic)

Issues Update: Buildings and HVAC&R in the First 100 Days

Track: Fundamentals

Sponsor: Advocacy Committee
Chair: Ryan M. Colker, J.D., Associate Member, ASHRAE, Washington, DC

As the Obama Administration and the new Congress complete their first six months, new policies, programs and staff affecting the building community have emerged. This session discusses the changes and what to expect in the future—particularly relative to climate change, energy policy, research and development and federal buildings.

1. Buildings Policy in the New Congress
Veronica Cecil, Office of Representative Ben Chandler, Washington, DC
2. Federal Actions After Inauguration Day
Kevin Kampschroer, General Services Administration, Washington, DC
3. Policy Perspectives from the HVAC&R Industry
David Calabrese, Air-Conditioning Heating and Refrigeration Institute, Arlington, VA

Seminar 44 (Intermediate)

Optimizing of DX-DOAS Systems

Track: Systems and Equipment

Sponsor: 8.10 Mechanical Dehumidification Equipment and Heat Pipes
Chair: Julie Ferguson, Member, Applied Dehumidification Inc, Tampa, FL

The use and application of dedicated outdoor air systems (DOAS) has continuously increased as engineers have sought more effective and energy efficient approaches to eliminating humidity from being introduced into building envelopes. This seminar addresses the unique design elements required for DX-DOAS systems to allow these systems to meet the Society's goal of sustainable design.

1. Capacity Control Methods for DX-DOAS
Craig Burg, Associate Member, Desert Aire Corp., Germantown, WI
2. Variable Refrigerant Volume Technology for DX-DOAS Applications
Titu Doctor, Member, CENC Inc., Marietta, GA
3. What Kinds of Controls Do We Need for 100% OA Systems
Keith Coursin, Member, Desert Aire Corp., Germantown, WI

Seminar 45 (Intermediate)

Climate Change Update

Track: Fundamentals

Sponsor: 4.2 Climatic Information, 2.5 Global Climate Change
Chair: Steve M. Cornick, P.Eng., Member, National Research Council Canada, Ottawa, ON, Canada

The winter of 2008 was colder than normal in North America leading many wits to exclaim "so much for climate change!" This seminar explores various facets of the changing climate and its influence on buildings and HVAC systems. The IPCC's 4th annual report predicts a range of warming scenarios. Are these trends apparent in the data? A substantial update of the climate data in the *ASHRAE Handbook—Fundamentals* volume, was included in the 2009 edition. The trend shows increased warming. Although the Handbook climate information is up-to-date, the development of experimental products such as "optimal climate normals" addresses the issues of climate normal's that are representative of the current state of the climate and the accommodation of climate change.

1. A Perspective on Global Trends since the IPCC 4th Annual Report
Robert Morris, Member, Environment Canada, Toronto, ON, Canada
2. Climate Change and Development of Optimal Climatologically Normal's
Russell S. Vose, Ph.D., National Oceanic and Atmospheric Administration, Ashville, NC
3. Influence of Long-term Trends and Period of Record Selection on the Calculation of Climatic Design Conditions and Degree-Days
Didier Thevenard, Ph.D., P.Eng., Member, Numerical Logics Inc., Waterloo, ON, Canada
4. Decade-to-Decade Stability of Briggs, et al. Buildings Climate Zone Boundaries over Various Regions of the Globe
Charles Whitlock, Associate Member, Science Applications International Corp., Quinton, VA

TUESDAY, 6/23
11 A.M.–1 P.M.

Poster Session

A Closer Look at CO_2 as a Refrigerant (LO-09-042)

Norbert Muller, Member; Jijo Oommen Joseph, Michigan State University, West Lansing, MI

Carbon dioxide (CO_2), which is generally associated with greenhouse effect and damage to the environment, can be used in the fight against ozone depletion. CO_2 is a practical replacement to the existing flouro-carbon based refrigerants. Although CO_2 has a global warming potential (GWP) of 1, it is about 1000-3000 times lower than the GWP of most other commonly used refrigerants. This paper follows a theoretic approach to compare the performance of CO_2 with other natural refrigerants, employing the first law of thermodynamics, i.e., using coefficient of performance (COP). It shows the optimized pressure plots of a CO_2 compressor and sketches the effect of compressor performance on the COP of the refrigeration system.

A Comparative Study of an Open Vertical Refrigerated Multi-Deck: A Numerical Study and Its Experimental Validation (LO-09-043)

Yu-Feng Chen, Ph.D.; Hung-Wen Lin, Ph.D.; Wen-Der Hsieh, Ph.D.; Jian-Yuan Lin, Ph.D., Member; Chi-Chuan Wang, Ph.D., Fellow ASHRAE, Industrial Technology Research Institute, Chutung, Hsinchu, Taiwan

This study experimentally and numerically examines the 3D effect on the performance of an open refrigerated display cases (ORDC). Three dimensional simulation model with k-fÓ-E turbulence models incorporating the buoyancy effect is carried out to compare with the results by 2-D simulation model. It is found that the infiltration rate of 3-D simulation is significantly larger than that of 2-D simulation, indicating the importance of 3-D flow field, and it should not be neglected in CFD analysis of an ORDC. The 3-D computations in terms of temperature distribution inside the shelves were compared with the measurements, and good agreements are reported.

An Experimental Evaluation of HVAC-Grade Carbon Dioxide Sensors, Part 1: Test and Evaluation Procedure (LO-09-044)

Som S. Shrestha, Student Member; Gregory M. Maxwell, Ph.D., Member, Iowa State University, Ames, IA

Carbon-dioxide sensors are widely used as part of a demand controlled ventilation (DCV) system for buildings requiring mechanical ventilation, and their performance can significantly impact energy use in these systems. A study was undertaken to test and evaluate the most commonly used CO_2 sensors in HVAC systems, namely the non-dispersive infrared (NDIR) type. The procedures presented here provide a methodology to test and evaluate NDIR CO_2 sensors for accuracy, linearity, hysteresis, repeatability, humidity sensitivity, temperature sensitivity, and pressure sensitivity. Partial results of the accuracy test and evaluation of the CO_2 sensors and the results of the linearity, repeatability, hysteresis, humidity sensitivity, temperature sensitivity, and pressure sensitivity evaluation are included in this paper.

Biological and Metal Contaminants in HVAC Filter Dust (LO-09-045)

Federico Noris, Student Member; Jeffrey A. Siegel, Ph.D., Member; Kerry A. Kinney, Ph.D., University of Texas at Austin, Austin, TX

Recently, the interaction between particles retained on HVAC filters and indoor air quality has gained more attention due to their possible relationship to irritation, health outcomes and odors. This paper focuses on microbial contaminants and metals captured on HVAC filters in nine residential and light-commercial buildings. Microbial concentrations were consistent across filters having different efficiencies with median concentrations within one order of magnitude. Heavy metal concentrations were as high as 29 ?g/g for lead, 6 ?g/g for cadmium, and 7 ?g/g for arsenic. This investigation provides insight into possible metal sources and concentrations of biological and heavy metal contaminants present in indoor environments.

CCLEP Reduce Energy Consumption by More than 50% for a Luxury Shopping Mall (LO-09-046)

Lixia Wu, Student Member; Xiufeng Pang, Student Member; Gang Wang, Ph.D., P.E., Member, University of Nebraska Lincoln, Omaha, NE; Jinrong Wang, P.E., Member; Thomas Lewis, Member, Omaha Public Power District, Omaha, NE; M. Liu, Ph.D., P.E., Member, University of Nebraska Lincoln, Omaha, NE

The Continuous Commissioning Leading Project (CCLEP) process is an ongoing process to apply system optimization theory and advanced technologies in commercial retrofit projects. The CCLEP process was applied to a luxury shopping mall and office building. This paper presents the optimal control strategies, which include main hot deck damper control, supply fan control integrated with FAS, return fan control, optimal control for terminal boxes, chilled water temperature and chilled water pump speed control, hot water temperature and hot water pump speed control. The measured hourly utility data after CCLEP show that annual HVAC electricity consumption is reduced by 56% and gas use is reduced by 36%.

Chemical Off-Gassing from Indoor Swimming Pools (RP-1083)(LO-09-047)

Richard C. Cavestri, Ph.D., Member; Donna Seeger-Clevenger, Imagination Resources, Dublin, OH

Based on observation, this research confirms and highlights that nitrogen trichloride is the vapor (gas) that causes the most irritation and pool air containing TCA is essentially toxic over long term exposure. Tests conducted with top level ventilation and re-circulation rates confirmed the need to understand Henry's Law and the physical properties of TCA. When used in conjunction with deck (ground) level ventilation, low exhaust air movement at ASHRAE's current ventilation rate (0.5 cfm/ft2) can be successful in maintaining this heavier than air TCA gas at low levels within the indoor space.

Cold Weather Destratification Energy Savings of a Warehousing Facility (LO-09-048)

Mark Armstrong, P.Eng., Member, Agviro, Inc., Guelph, ON, Canada; Bill Chihata, P.Eng., Member, Enbridge Gas Distribution, Inc., North York, ON, Canada; Ron MacDonald, P.Eng., Member, Agviro, Inc., Guelph, ON, Canada

This report provides an evaluation of environmental conditions and energy savings using five large diameter fans in a commercial manufacturing and warehousing facility in the Toronto area during the winter/spring of 2008. The use of destratification fans during cold weather reduced ceiling temperatures by 4.0°C (7.2°F) and increased floor temperatures by 1.5°C (2.7°F). Operating the fans in the forward or downward direction provided improved temperature destratification versus operating fans in the reverse direction. A total temperature profile difference of less than 0.5°C (0.9°F) was achieved with the fans in the forward direction.

Comfort, Energy Consumption and Economics of a School with Energy Recovery (LO-09-049)

Melanie Fauchoux, Member; Carey Simonson, Ph.D., P.E., Member; David Torvi, Member, University of Saskatchewan, Saskatoon, SK, Canada

Energy wheels are often used to reduce energy consumption and HVAC equipment capacities in buildings, but the effect of the energy wheel on the indoor comfort conditions has not been studied in detail. A school building is modeled with the TRNSYS computer program, in four North American cities (Saskatoon, Saskatchewan; Vancouver, British Columbia; Tampa, Florida and Phoenix, Arizona) to see the effect of the energy wheel on the indoor comfort in different outdoor climates. The simulations are performed with an energy wheel and without an energy wheel to determine the effects of the energy wheel on the indoor RH and PAQ.

Common Data Definitions for HVAC&R Industry Applications (RP-1354) (LO-09-050)

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

Draft Guideline 20, titled "XML Definitions for HVAC&R" is attempting to establish a common data exchange format for the description of commodity data and HVAC&R information using eXtensible Markup Language, XML. The research project focused on four of the twelve Use Cases described in draft Guideline 20. For each Use Case, detailed process steps describing the Use Case were elaborated. From the detailed process steps, transfers of information were extracted showing the groups of data that were needed to communicate between various parties. After analysis, the 107 data groups identified were named and defined. Using these data groups, three selected existing data models were examined in detail and 4350 data elements were identified.

Communication Performance of BACnet Web Service Over the Global Internet (LO-09-051)

Chuzo Ninagawa, Ph.D.; Tomotaka Sato, Mitsubishi Heavy Industries, Ltd., Kiyosu, Aichi, Japan; Yahiko Kawakita, MHI Aerospace Systems, Corp., Nagoya, Aichi, Japan

BACnet Web Service (BACnet/WS) is the latest Internet communication method of the ASHRAE standard for building management systems. This paper provides theoretical and experimental studies on the message transmission performance of BACnet/WS access over the Internet. The average transmission times of the BACnet/WS "getValues" service for a large number of objects were measured from inter-continental locations. This paper found that the average transmission time is roughly proportional to the average round trip time of IP network connectivity probing, "ping". This paper concludes that transmission time takes up a significant portion of the total service time of a remote BACnet/WS system over the Internet.

Comparative Analysis of Optimization Approaches to Design Building Envelope for Residential Buildings (LO-09-052)

Moncef Krarti, Ph.D., P.E., Member; Daniel Tuhus-Dubrow, University of Colorado, Boulder, CO

A simulation/optimization tool has been developed to design building shell that minimizes energy use costs associated with heating and cooling systems. The tool couples an optimization algorithm to a building energy simulation engine to select optimal values of a comprehensive list of parameters associated with the envelope of residential buildings including the building shape. Three optimization methods are utilized including genetic algorithm (GA) approach, sequential search technique, and particle swarm technique. In this paper, the performance in terms of accuracy and efficiency of the three optimization approaches was compared for various sets of building envelope parameters.

For relatively large search spaces, it was found that the GA could identify the minimum cost point to with an accuracy of 0.4% using 60% of the simulations required by sequential search technique and only 40% of the simulations needed by the particle swarm optimization method.

Comparison Between a Radiant Floor and Two Radiant Walls on Heating and Cooling Energy Demand (LO-09-053)

Michele De Carli, Ph.D.; Angelo Zarrella, Ph.D.; Robert Zecchin, Ph.D., University of Padova, Via Venezia, Padova, Italy

The goal of this paper is to compare a radiant wall system and a floor system under the same conditions in terms of insulation volume; also the position of the insulation layer in radiant wall has been analyzed. A detailed model for radiant systems (named DigiThon) has been used for this purpose, for determining both the heating capacity of the systems in winter design conditions and the seasonal energy demand of the radiant systems during winter and summer period. Results show that the capacity of the systems is the same in heating but not in cooling season.

Condensate Harvesting from Large Dedicated Outside Air Handling Units with Heat Recovery (LO-09-054)

Frank L. Painter, P.E., Member, U. S. Army Corps of Engineers, Fort Sam Houston, TX

This paper shows the feasibility of harvesting condensate from large dedicated outdoor air handling units and applying the condensate to effectively reduce the annual projected potable water consumption for a case study building. A case study building is presented, for which the production potential is applied. The analysis indicates that the condensate production from the case study building's large dedicated outdoor air handling units can completely supplement the annual water closet and urinal water demand with 1,614,031 gallons (6.12 x 106 L) of excess, which could be used to supplement landscape irrigation system or the

entire condensate production could be applied to reduce the cooling tower makeup demand by an estimated 16%.

Delivering Sustainability Promise to HVAC Air Filtration (LO-09-055)

Christine Sun, Member; Dan Woodman, Freudenberg Filtration Technologies, L.P., Hopkinsville, KY

How should we deliver such sustainability promises to air filtration in HVAC systems? There is a growing demand from end users and filter manufactures to classify the air filters not only by particulate removal efficiency, but also by energy efficiency. In this paper, two methods were introduced to classify filters' energy efficiency: key energy performance (kep) number and wattage. Four different models were applied to calculate the average pressure drop vs. dust loading as it is a critical variable to the energy efficiency. A new exponential model proposed in this research shows excellent consistency to experimental data of pressure drop during the dust loading process of ASHRAE 52.2 full test.

Demand Shifting with Thermal Mass in Light and Heavy Mass Commercial Buildings (LO-09-056)

Peng Xu, Member, Lawrence Berkeley National Laboratory, Berkeley, CA

The potential for utilizing building thermal mass for load shifting and peak demand reduction has been demonstrated in a number of simulation, laboratory and field studies. This project studied the potential of pre-cooling and demand limiting in a heavy mass and a light mass building in the Bay Area of California. The conclusion of the work to date is that pre-cooling has the potential to improve the demand responsiveness of commercial buildings while maintaining acceptable comfort conditions. Results indicate that pre-cooling increases the depth (kW) and duration (kWh) of the shed capacity of a given building, all other factors being equal.

Dynalene/Water Correlations to be Used for Condensation of CO_2 in Brazed Plate Heat Exchangers (RP-1394) (LO-09-057)

Niel Hayes, Student Member; Amir Jokar, Ph.D., Member, Washington State University Vancouver, Vancouver, WA

Experimental study of condensation of carbon dioxide in brazed plate heat exchangers is the main objective of this research project. However, it is essential to characterize the single-phase flow through these mini-channel heat exchangers in order to analyze and formulate the two-phase flow. In this manuscript, the open literature on the subject is reviewed first, the facility for testing the entire system is then described, and the initial results on the single-phase flow are presented at the end. Three brazed plate heat exchangers with different interior configurations, each consisting of three channels, are considered and tested in this study.

Effects of Jet Inclination Angle and Geometrical Parameters on Air Curtain Performance (LO-09-058)

Samir R. Traboulsi, P.Eng., Member, American University of Beruit, Beirut, Lebanon; Ali Hammoud, Ph.D., Beirut Arab University, Beirut, Lebanon; M. Farid Khalil, Ph.D., Alexandria University, Alexandria, Egypt

Tilted air jet planes are used as barriers between two environments of different temperature, humidity and quality. Entrainment of one environment fluid (air) into the curtain by shear layer mixing contributes to both the sensible and the latent heat load on the other environment and the impingement of the air curtain formed. Perturbation of one side affects the shape of the air jet and might endanger its integrity. Protrusion present in the direction of the flow impacts the performance of the air curtain and defeats its purpose of existence.

Electrical Energy Impacts of Residential Building Codes for Homes in Austin, Texas (LO-09-059)

John Trowbridge, P.E., Associate Member, Austin Energy, Austin, TX

An analysis of electrical billing data for single family customers of Austin Energy is performed with intent of identifying home electrical use impact of the energy codes adopted by the City of Austin. Information from multiple sources is combined to classify homes by house size, period of construction, energy efficiency program participation and owner or rental property. Electrical billing information from Austin Energy is used to analyze changes in energy use by the predetermined building characteristics for the time periods associated with building construction under adopted energy codes.

Energy Conservation Effects of Heat Source Systems for Business Use by Advanced Centrifugal Chillers (LO-09-060)

Kenji Ueda, Mitsubishi Heavy Industries, Ltd., Takasago, Japan; Yoshie Togano; Yoshiyuki Shimoda, Osaka University, Osaka, Japan

The COP of the latest fixed-speed centrifugal chiller is more than 6.4 and that of the latest variable-speed centrifugal chiller driven by an inverter reaches a 21.9 COP. Many energy conservation studies have been conducted on industrial heat source systems in Japan. But there have been few reports on the heat source systems for business use. This paper suggests an operation method for the latest fixed-speed and variable-speed chillers based on those unique high-performance characteristics. High-performance data based on actual measurements are used to evaluate the energy conservation. In addition, this paper provides a new planning and operating method for a whole heat source system, including a new estimation method of cooling tower performance. High-performance data based on actual measurements are used to evaluate the energy conservation. In addition, this paper provides a new planning and operating method for a whole heat source system, including a new estimation method of cooling tower performance, which is a very important element.

Evaluating the Ability of Unitary Equipment to Maintain Adequate Space Humidity Levels (RP-1254)(LO-09-061)

Michael Witte, Member; Robert Henninger, GARD Analytics, Inc., Arlington Heights, IL

This paper provides an overview of the results of ASHRAE Research Project RP-1254, Evaluating the Ability of Unitary Equipment to Maintain Adequate Space Humidity Levels; Phase II: Simulations, Summary and Development of Guidelines. Whole-building energy simulations were used to perform a parametric analysis of 18 HVAC system types in seven commercial building types using two sets of ventilation rates (ASHRAE Standards 62-2001 and 62.1-2004) in 10 locations. The system types included single-path and dual-path direct expansion (DX) with and without enhancements such as enthalpy wheel, demand controlled ventilation, desiccant dehumidifier, subcool reheat, hot gas reheat, and air-to-air heat exchangers around the cooling coil. The relative performance of each system type is compared on the basis of humidity control (occupied hours >65% RH) and annual energy use, including heating energy.

Evaluation of Typical Weather Year Selection Approaches for Energy Analysis of Buildings (RP-1477) (LO-09-062)

Donghyun Seo, University of Colorado, Boulder, CO; Joe Huang, White Box Technologies, Moraga, CA; Moncef Krarti, Ph.D., P.E., Member, University of Colorado, Boulder, CO

In this paper, the results a series of sensitivity analyses are presented and discussed to assess the impact of the weather format as well as the selection criteria for generating a typical weather year suitable for energy analysis of building systems. In particular, the impact of weighting factors associated with various weather variables and the length of recorded data used. The results indicate that it is better to assign more weight to global solar radiation than to the direct normal ration and that 15 years of recorded data would be sufficient to generate a typical weather year.

Experimental Investigation of Orbiting Thrust Bearing Using Wide and Shallow Circular Pockets (LO-09-063)

Amit Vaidya, Member; Farshid Sadeghi, Ph.D., Purdue University, Syracuse, NY

This experimental investigation is focused on improving the frictional characteristics of a scroll compressor thrust slide bearing undergoing an orbital motion. An experimental test rig was designed and constructed to accommodate actual parts of a scroll compressor and measure friction between a scroll compressor crankcase and its orbiting scroll. It was observed that in orbiting situation macro circular pockets with large diameters (0.3 to 0.36 inch) and very shallow depth (0.002 to 0.003 inch) significantly improved the frictional performance between the scroll crankcase and orbiting scroll.

Experimental Measurement and Uncertainty Analysis on the Energy Performance of a Chilled Water Cooling Coil (LO-09-064)

Ryan D. Warren, Student Member; Rahul L. Navale, Student Member; Ron M. Nelson, Member; Curtis J. Klaassen, Member, Iowa State University, Ames, IA

In this study, an energy balance and uncertainty analysis was performed on a standard chilled water cooling coil mounted in a commercial air handling unit operating under typical conditions with a conventional PID loop control. Two different sets of relative humidity transmitters and temperature sensors (high and low accuracy) were evaluated for measuring relative humidity and temperature of the moist air entering and exiting a cooling coil. The impact of the different errors in these sensors and installation on the uncertainty in the energy calculation is presented. This study gives insight to how an energy balance test coupled with an uncertainty analysis could be used to verify the cooling coil system performance and instrumentation output.

Experimental Measurements of a Run-Around Membrane Energy Exchanger (Ra.m.EE) with Comparison to a Numerical Model (LO-09-065)

Blake Erb, Member; Mehran S. Ahmadi; Carey Simonson, Ph.D., P.Eng., Member; Robert Besant, P.Eng., University of Saskatchewan, Saskatoon, SK, Canada

In this paper, the experimental testing of a run-around membrane energy exchanger (Ra.m.EE) is considered and data are compared to numerical simulations. The effects on the performance of the system due to different exchanger sizes, liquid and air flow rates, external heat gains/losses and desiccant concentrations are considered in detail. Also studied is the transient response of the system during both initial start-up and due to changes in the outdoor air conditions.

Feasibility Study of Hybrid Wheel Desiccant Dehumidification Cooling Systems in Malaysia (LO-09-066)

Salman Khosraiv, University of Malaya, Malaya,Malaysia

HVAC with wheel desiccant dehumidification (WDD) with a low ambient impact is more efficient system compare to the traditional systems. Hybrid desiccant cooling systems (HDCS) can be used to control indoor air quality (temperature and humidity) in commercial and industrial buildings. Results increasingly show stringent guidelines for outdoor ventilation rate. This study presents important variables analysis for different areas in Malaysia. The correlation shows that a high potentiality exists for using hybrid desiccant systems in all areas of Malaysia. Moreover the corresponding electricity saving would be considerable.

Field Measurements of Innovative Indoor Shading Systems in a Full-Scale Office Testbed (LO-09-067)

Eleanor Lee, Member; D. DiBartolomeo; J. H. Klems; R. D. Clear; K. Konis, Member, Lawrence Berkeley National Laboratory, Berkeley, CA

A six-month solstice-to-solstice field study was conducted to measure the thermal and daylighting performance of south-facing large-area windows with a variety of innovative indoor shading systems in a full-scale private office setting. With continuous dimming controls, all shading systems yielded lighting energy savings between 43-69% compared to a non-dimming case, but only the automated systems were able to meet visual comfort criteria throughout the monitored period. Differences in space cooling and peak cooling loads due to solar and thermal loads from the window were small between conventional and innovative shading systems.

Field Studies in the United States and United Kingdom of the Effectiveness of Mechanical Ventilation Systems on Indoor Air Quality Conditions in Hospitality Venues Where Smoking is Allowed (LO-09-068)

Elia Sterling, Member; Michael Glassco, Theodor Sterling Associates, Vancouver, BC, Canada

Questions have been recently raised about the effect of mechanical ventilation systems on indoor air quality in hospitality venues where smoking is allowed. We have reviewed the literature available about effective mechanical ventilation and tobacco smoke and have found that very few studies purporting to establish the effect of ventilation on tobacco smoke in hospitality venues have actually measured and quantified ventilation parameters. In fact, many of these studies have not measured and quantified indoor air quality or tobacco smoke. Further although there are a few studies that have measured and reported ventilation, indoor air quality and environmental tobacco smoke (ETS) parameters, most of the hospitality venues included in these studies do not have effective ventilation systems.

Frost Accumulation Control on an Upward-Facing Horizontal Flat Plate Using Electric Field (LO-09-069)

Luca Molinaroli, Ph.D., Affiliate; Cesare Joppolo, Member, Politecnico di Milano, Milano, Milano, Italy

The paper discusses the results of an experimental study carried out to investigate the influence of a DC electric field on frost formation and accumulation on an upward-facing flat plate. An experimental setup was built to investigate the influence of the electric field intensity and uniformity on frost mass accumulated on the flat surface and to analyze its dependence on cold surface temperature, air velocity and test duration under an electric field. The results show that the electric field allows reducing the frost mass accumulated on flat plate surface up to a value of 26% while the power required to maintain the electric field is quite low.

Functional Exergy Efficiency at Near-Environmental Temperatures (LO-09-070)

Elisa Boelman, Ph.D.; Poppong Sakulpipatsin, Ph.D.; Hedzer Van der Kooi, Ph.D.; Laure Itard, Ph.D., Member; Peter Luscuere, Ph.D., P.Eng., Delft University of Technology, Julianalaan, Delft, Netherlands

This paper discusses how exergy efficiency can help generate insight into effective and ineffective temperature combinations for heat exchange at near-environmental temperatures. The analysis uses exergy and energy efficiencies, combined with exergy consumption, warm/cool exergy and a dimensionless temperature, to gain insight into the effect of varying temperatures in air-to-air heat exchange at near-environmental temperature. The analysis is performed with a simple model for an air-to-air sensible heat exchanger. The paper presents an example of how the approach can be used as a basis to select exergy efficient temperature combinations when conceiving heat exchange in building ventilation.

Improving Control and Operation of a Single Duct VAV System through CCLEP (LO-09-071)

Young-Hum Cho, Student Member; Mingsheng Liu, Ph.D., P.E., Member; Xiufeng Pang, Member, University of Nebraska Lincoln, Omaha, NE; Jinrong Wang, P.E., Member; 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%.

Influence of Long-term Trends and Period of Record Selection on the Calculation of Climatic Design Conditions and Degree-Days (RP-1453) (LO-09-072)

Didier Thevenard, Member, Numerical Logics, Inc., Waterloo, ON, Canada

Calculation of climatic design conditions and cooling and heating degree days using data from different decades for 1274 stations worldwide reveals long-term trends. Annual heating degree-days have decreased on average by 118°C-day/decade (212°F-day/decade) while annual cooling degree days have increased by 68°C-day/decade (122°F-day/decade). The paper also studies the appropriate period of record to use for the calculation of climatic design conditions and degree-days. The use of a 30-year period is recommended; the use of shorter periods of record encompassing only recent years, in order to better capture climatic trends, results in an added uncertainty

that is greater than the observed climate trends themselves.

Integral Design of School Ventilation (LO-09-073)

W. Zeiler, Ph.D., P.Eng., Member; G. Boxem, P.Eng.; D. Schuiling, P.Eng., Techniche Universiteit Eindhoven, Eindhoven, Netherlands

Ventilation in schools has a direct relation to health and performance of pupils and thus is very important. The present situation of school ventilation in the Netherlands is presented which is rather poor: there were a lot of insufficient situations found. Different aspects of the problems were studied to find new solutions. The design of a new and better functioning ventilation system for schools is a complex process. Design methodology helps the designer to give structure to the design tasks and solutions. The design process should not only lead to a solution, but also give insight in the reasoning about the design problems and the solutions itself. The decisions made during the design process should become clear and reproducible for other designers and disciplines. This simulates the multidisciplinary exchange of ideas and concepts. A new Integral Design approach was developed to design adequate solutions for ventilation of school buildings. The design procedure and a first design result are described.

Performance of a Transcritical CO_2 Heat Pump for Simultaneous Water Cooling and Heating (LO-09-074)

Jahar Sarkar, Institute of Technology-BHU, Varanasi, India; Souvik Bhattacharyya, Ph.D.; M. Ram Gopal, Indian Institute of Technology, Kharagpur, India

This paper presents the experimental as well as the simulated performance studies on the transcritical CO_2 heat pump for simultaneous water cooling and heating; effects of water mass flow rates and water inlet temperatures of both evaporator and gas cooler on the cooling and heating capacities, system COP and water outlets temperatures are investigated. Comparisons of experimental values with simulated results show the maximum deviation of 5% for cooling capacity, 10% for heating capacity, 16% for system COP. This study offers useful guidelines for selecting appropriate water mass flow rate to obtain required system performance.

Required Duration for Borehole Test Validated by Field Data (LO-09-27)

Yedi D. Liu, Tongji University, Shanghai, China; Richard A. Beier, Ph.D., Associate Member, Oklahoma State University, Stillwater, OK

Geothermal heat pumps exchange heat with the ground through the use of ground heat exchangers where the heat transfer rate depends on the thermal conductivity of the surrounding soil. An in-situ test is often performed on a vertical borehole to estimate soil thermal conductivity, but the test must have sufficient duration in order to obtain an accurate estimate. Conventional analysis methods usually do not check to see if the test duration is sufficient. This paper validates a procedure to perform this check as a supplement to current methods.

Study on the Application of Hybrid System in a Large Space Building (LO-09-075)

Y. Y. Fu, P.E.; C. Huang, Ph.D., Member; X. Luo, Ph.D., Member; S. Liu, P.E., University of Shanghai, Shanghai, China

This paper presents the research on the application of hybrid ventilation system in a large space building. The hybrid ventilation system is an all-year coupled operation of ventilation with air-conditioning. The ventilation is used in intermediate seasons and air-conditioning is used in summer and winter. The switch-point temperatures determining the operating model of the hybrid ventilation system between ventilation and air conditioning in intermediate seasons are investigated for the large space building. The analysis on energy saving potential in intermediate seasons shows that the hybrid ventilation system can reduce energy consumption in an efficient way.

The Role of Plants in the Reduction of Heat Flux through Green Roofs: Laboratory Experiments (LO-09-076)

Jelena Srebric, Member; Paulo Cesar Tabares Velasco, Student Member, Penn State University, University Park, PA

An interesting approach to reduce building energy consumption is to use green roofs as a part of building envelope. Nevertheless, it is quite difficult to estimate the resulting energy saving, and as a result, many building designers ignore this opportunity. This paper provides results from an ongoing experimental research project that focuses on the thermal performance of extensive green roofs. The paper discusses the importance of green roofs and reviews previous research studies. In particular, this paper focuses on the role of plants for the heat flux reduction through the roof structure. Overall, plants reduced the measured heat flux through the green roof sample by 40-50% compared to the roof sample without plants.

Thermal Environment and Productivity in Factory (LO-09-077)

Xiaojiang Ye, Ph.D.; Huanxin Chen, Ph.D., Huazhong University of Science and Technology, Wuhan, China; Zhiwei Lian, Ph.D., Zhongyuan University of Technology, Henan, China

Field investigations of two different factories were carried out in Zhenjiang and Shanghai in cool season to analyze the relation among indoor environment, humans and productivity. This study examined the effect of working environment and other factors on thermal comfort and productivity in factories. The results show that productivity (103.2% in Zhenjiang and 100.6% in Shanghai) does not reach the highest when occupants' thermal sensation vote (TSV) are neutral or comfort. The highest productivity (105.1% in Zhenjiang and 104.7% in Shanghai) occurs when TSV of subjects are slightly cool. Compared with other factors, keeping good indoor air quality might be the best way to maintain a higher productivity in factories in this survey.

Thermal Modeling of Shading Devices of Windows (LO-09-078)

Abdelaziz Laouadi, Member, National Research Council of Canada, Ottawa, ON, Canada

Although there has been significant development in the evaluation and modeling of the thermal performance of shading devices, current methodologies are limited to a few shading products and types. Furthermore, current fenestration thermal models do not account for radiation emission and absoption throughout shading layers, and elements for energy generation and conversion imbedded in glazing layers. This paper presents a general methodology to compute the thermal performance of fenestration systems incorporating permeable shading devices and elements for energy generation and conversion. A validation study is carried out, in which the U-factor of a double-glazed window with between-pane Venetian blinds are compared with the available laboratory measurement.

Ventilation of Sustainable Schools: Better Than Traditional Schools? (LO-09-079)

Wim Zeiler; Gert Boxem, Member, Technische Universiteit Eindhoven, Eindhoven, Netherlands

During the last decades in the United Kingdom several educational buildings were built with a strong environmental ethos, real icons of a new generation of low-energy sustainable buildings. In some of the buildings post occupancy evaluations were held and building's performance was revealed. Also in the Netherlands during the last years several new concepts were developed for sustainable schools. This is an interesting topic as many of those schools had problems concerning energy efficiency, indoor air quality and thermal comfort. From literature three evaluations from the UK and one overview of 5 sustainable educational buildings from the Netherlands are given, which show that sustainable educational buildings are not always without flaws.

VFD Applications for Constant Volume Air Handling Units (LO-09-080)

Young-Hum Cho, Student Member; Mingsheng Liu, Ph.D., Member, University of Nebraska Lincoln, Omaha, NE; Gang Wang, Member, University of Texas A&M, Kingsville, TX; Jinrong Wang; Timothy Rauscher, 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.

Wednesday

- Ventilation and IAQ issues in ASHRAE's residential standards.
- Next generation refrigerants for chillers.
- Emerging applications in low temperature refrigeration.
- Large office building design and commissioning.
- Control of ozone.
- Commissioning to improve sustainability and IAQ in existing buildings.

WEDNESDAY, 6/24
8 A.M.–9:30 A.M.

Transactions 16 (Intermediate)

Measurement, Modeling and Control of Air Quality in Plant and Animal Environment

Track: Indoor Air Quality

Sponsor: 2.2 Plant and Animal Environment
Chair: Xufei Yang, Student Member, University of Illinois at Urbana-Champaign, Urbana, IL

The indoor air quality in and the pollutant emission from enclosed plant and animal environments has become a public concern in the U.S. Fundamental studies concerning the ventilation effectiveness can provide valuable information for optimizing ventilation system design and operation. This seminar discusses how to evaluate the ventilation effectiveness by means of field sampling, lab experiments and CFD modeling. Regarding the emission control, the performance of an electrostatic precipitation (ESP) deduster is reported.

1. Laboratory Evaluation and Modeling of Electrostatic Precipitation of Particulate Matter Emissions from Poultry Facilities (LO-09-082)
Roderick B. Manuzon, Ph.D., Student Member; Lingying Zhao, Ph.D., Member, The Ohio State University, Columbus, OH

2. Large Eddy Simulation of Airflows in a Full Scale Room at Different Ventilation Rates (LO-09-083)
Jerez B. Sheryll, Ph.D., Member, Stephen F. Austin State University, Nacogdoches, TX; Xinlei Wang, Ph.D., Member; Yuanhui Zhang, Ph.D., P.E., Fellow ASHRAE, University of Illinois at Urbana-Champaign, Urbana, IL

3. Experimental and Numerical Study of Airflows in a Full Scale Room (LO-09-084)
Jianbo Jiang, Ph.D., Associate Member, Monell Chemical Senses Center, Philadelphia, PA; Xinlei Wang, Ph.D., Member, University of Illinois at Urbana-Champaign, Urbana, IL

Transactions 17 (Intermediate)

Issues with Ventilation and Indoor Air Quality in ASHRAE Residential Standards

Track: Applications

Sponsor: SSPC 62.2
Chair: John Talbott, P.E., Talbott Consulting Inc., Baltimore, MD

Residential ventilation is an important emerging issue within ASHRAE because of the increased emphasis on high performance homes. Field experiments and analytical studies are presented to increase the knowledge base of residential ventilation performance in general. Particular emphasis is placed on the knowledge needed to support ASHRAE ventilation and energy standards.

1. Infiltration in ASHRAE's Residential Ventilation Standards (LO-09-085)
Max H. Sherman, Ph.D., Fellow ASHRAE, Lawrence Berkeley National Laboratory, Berkeley, CA

2. A Calibrated Multi-Zone Airflow Model for Extension of Ventilation System Tracer Gas Testing (LO-09-088)
Aaron Townsend, P.E., Associate Member, Armin Rudd, Member and Joseph Lstiburek, Ph.D., P.E., Fellow ASHRAE, Building Science Corp., Somerville, MA

3. A Method for Modifying Ventilation Airflow Rates to Achieve Equivalent Occupant Exposure (LO-09-086)
Aaron Townsend, P.E., Associate Member; Armin Rudd, Member; Joseph Lstiburek, Ph.D., P.Eng., Fellow ASHRAE, Building Science Corp., Somerville, MA

4. Indoor Moisture in 30 Homes Using Unvented Gas Fireplaces (LO-09-087)
Paul W. Francisco, Member, Jeffrey R. Gordon and William B. Rose, Member, University of Illinois, Champaign, IL

Seminar 46 (Advanced)

Retrofit and Next-Generation Global Refrigerants for Centrifugal Chillers

Track: Refrigeration

Sponsor: 8.2 Centrifugal Machines
Chair: Rudy Chervil, Member, York Johnson Controls, Inc., York, PA

The global phase-out of refrigerant R-12 is coming in 2010 for developing nations; an HFC blend with properties similar to R-12 has been specifically formulated for existing centrifugal chillers. Case studies include some conversions in South America. The first speaker discusses retrofit refrigerants addressing near-term alternate refrigerants for conversion applications. The second and third speakers discuss long-term replacements for current high-GWP refrigerants.

1. Retrofit Refrigerants for Near-Term Chiller Conversion Applications
Rudy Chervil, Member, York Johnson Controls, Inc., York, PA

2. Long-Term Replacement Refrigerants for Current High-GWP Refrigerants
Kostas Kontomaris, Ph.D., Member; Thomas J. Leck, Ph.D., Member, DuPont Fluoroproducts, Wilmington, DE

3. Market Drivers and Legislative Hurdles for Next Generation Refrigerants
Mike Thompson, Member, The Trane Co., Bryan, TX

Seminar 47 (Intermediate)

Retrofit of R-22 in Air-Conditioning Systems

Track: Refrigeration

Sponsor: 3.1 Refrigerants and Secondary Coolants
Chair: Ganesan (Sonny) Sundaresan, P.E., Fellow ASHRAE, Emerson Climate Control Technologies, Sydney, OH

This seminar provides system performance data for R-22 retrofit alternatives in existing residential and commercial air-conditioning systems. Laboratory and field test data are presented, including the effect of oil return with POE/mineral oil mixtures.

1. Performance of R-22 Retrofit Alternatives in Residential and Commercial Air Conditioning
Barbara Minor, Member; Charles Allgood, Ph.D., DuPont, Wilmington, DE

2. Oil Return and Performance of R-22 Alternatives
Patti Conlan, Arkema, Philadelphia, PA

3. Oil Circulation and Performance of R-22 Alternatives in Air Conditioners
Umar Khokhar, Member, National Refrigerants, Philadelphia, PA

Seminar 48 (Basic)

Back to Basics: Motors and VFDs

Track: Systems and Equipment

Sponsor: 1.11 Electric Motors and Motor Control
Chair: John W. Tolbert, Jr., Member, Bristol Compressors, Bristol, VA

Motors are a key element of all HVAC systems with old and new technology sharing the opportunity. The induction motor has and continues to be the workhorse but permanent magnet motors are gaining acceptance and applications as efficiency requirements increase. This seminar covers the basics of each technology along with some variable speed fundamentals.

1. Induction Motors 101
Derrick Vigil, Member, Baldor-Reliance, Greenville, SC

2. Permanent Magnet Motors 101
Alan Crapo, Emerson Industrial Automation, Eden Prairie, MN

3. Variable Speed Basics, Why and How
Robert W. Helt, Member, RH Consulting, South Portland, ME

4. Variable Frequency Drives: What's Inside the Box
Ken Fonstad, Danfoss Drives, Milwaukee, WI

Seminar 49 (Intermediate)

Sustainable Design and IAQ Challenges for Museums, Galleries, Archives and Libraries

Track: Large Building Systems

Sponsor: 9.8 Large Building Air-Conditioning Applications
Chair: Cecily M. Grzywacz, Member, Getty Conservation Inst., Los Angeles, CA

Museums, galleries, archives and libraries are charged with preservation of collections for future generations. As a result, each design project will have specific criteria and environmental control parameters that are determined by collection type and not necessarily visitor or occupant comfort. Crucial environmental control parameters to minimize risk to collections are temperature and RH and allowable fluctuations, light levels and control of gaseous and particle contaminates. Sustainable climate management and green buildings are new names for what not only engineering, but also preventive conservation and collection management has been doing for decades. This seminar addresses challenges in applying sustainable design philosophy to museums, galleries, archives and libraries.

1. Dynamic Control of Museum Exhibition Spaces
Peter Simmonds, Ph.D., Fellow ASHRAE, IBE Consulting Engineers, Sherman Oaks, CA
2. The Green Museum: Integrated Design and the Future of Sustainable Collections Care
Elizabeth Wylie, Finegold Alexander + Associates, Inc., Boston, MA
3. Implementation of a Comprehensive Commissioning Program for the Art Institute of Chicago Modern Wing
George F. Bourassa, P.E., Member, Jacobs, Chicago, IL

Seminar 50 (Basic)

ASHRAE Handbook: Fundamentals Volume, Load Calculations Improvements

Track: Fundamentals

Sponsor: 4.1 Load Calculation Data and Procedures, 4.2 Climatic Information, 4.5 Fenestration
Chair: Glenn Friedman, P.E., Member, Taylor Engineering, Alameda, CA

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

1. Overview of Non-Residential Load Calculation Improvements
Steve Bruning, P.E., Fellow ASHRAE, Newcomb & Boyd, Atlanta, GA
2. Overview of Residential Loads Calculations
Charles S. Barnaby, Member, Wrightsoft, Lexington, MA
3. New Research on Window Shading
John Wright, Ph.D., PEng., Member, University of Waterloo, Waterloo, ON, Canada

Seminar 51 (Intermediate)

What HVAC Systems Do Not Need UV Systems for Optimal Indoor Air Quality?

Track: Indoor Air Quality

Sponsor: 2.9 Ultraviolet Air and Surface Treatment
Chair: Stephen B. Martin, Jr, P.E., Member, CDC NIOSH, Morgantown, WV

At previous ASHRAE seminars and forums on ultraviolet germicidal irradiation (UVGI) topics, a question has often arisen: are there HVAC system and area applications that would not benefit from ultraviolet systems? This seminar explores what criteria specifiers and building owners should consider when choosing to apply UV air and surface disinfection systems in residences, healthcare facilities, schools, indigent care shelters and correctional facilities to assist in achieving optimal indoor air quality.

1. Residences
Gus Faris, Member, Nailor Industries Inc., Houston, TX
2. Healthcare Facilities
John M. Putnam, Member, Environmental Dynamics Inc., Sterling, VA
3. Correctional Facilities
Chuck Dunn, Member, Lumalier Corp., Memphis, TN

WEDNESDAY, 6/24 9:45 A.M.–10:45 A.M.

Transactions 18 (Intermediate)

Material Emissions/Adsorptions and IAQ

Track: Indoor Air Quality

Sponsor: 4.10 Indoor Environmental Modeling
Chair: John Zhai, Ph.D., Member, CU-Boulder, Boulder, CO

Building material emissions and adsorptions have significant impact on indoor air quality (IAQ). This session presents the most recent research outcomes in measuring and modeling building material emissions and adsorptions in various indoor environments as well as the method to quantify the influence of such emissions and adsorptions to the overall IAQ. Some results are coming out of the current ASHRAE research project 1321-RP entitled "Modeling VOC Sorption of Building Materials and Its Impact on Indoor Air Quality – Phase II".

1. The Validation of a VOC Diffusion Sink Model Based on Full-Scale Chamber Test (RP-1321)(LO-09-089)
Xudong Yang, Ph.D., Member, Tsinghua University, Beijing, China
2. An Improvement for Dynamic Twin Chamber Method to Measure VOC Diffusion Coefficient and Partition Coefficient (LO-09-090)
Yinping Zhang, Ph.D., Member, Tsinghua University, Beijing, China

Transactions 19 (Advanced)

Emerging Applications in Low Temperature Refrigeration and Cryogenics

Track: Applications

Sponsor: 10.4 Ultra-Low Temperature Systems and Cryogenics
Chair: Mohamed Alshehhi, University of Maryland, College Park, MD

This session presents emerging low temperature refrigeration technologies and their application, as wells as new low temperature application of mature refrigeration technologies.

1. Emerging Applications in Cryogenics: Nitrogen Injection for Reservoir Enhanced Oil Recovery (LO-09-091)
M. D. Islam, Ph.D.; M. Alshehhi, Member; M. Ohadi, Ph.D., Member, University of Maryland, College Park, MD
2. Modeling and Optimization of a Two Stage Mixed Gas Joule-Thomson Cryoprobe System (RP1472) (LO-09-092)
Harrison M. Skye, Member; Sanford Klein, Member; Gregory F. Nellis, Member, University of Wisconsin-Madison, Madison, WI

Seminar 52 (Basic)

Uncertainty Analysis of Experimental Building Performance Data

Track: Fundamentals

Sponsor: 1.2 Instruments and Measurement
Chair: Stephen Idem, Ph.D., Member, Tennessee Tech University, Cookeville, TN

This seminar presents fundamental aspects of measurement uncertainty analysis associated with building performance data. The "Guide to the Expression of Uncertainty in Measurements" (aka GUM) will be applied to building systems engineering. The GUM was developed in the 90's by ISO and provides a systematic and standard means to calculate and express measurement uncertainty using analytic and numerical methods. This seminar also emphasizes that there is some degree of uncertainty in the measured performance rating of different components of buildings. For example, it will demonstrate challenges in material property measurements as evidenced by thermal insulation ratings as well as uncertainties in system level measurements such as those applied to appliances.

1. Applying the Guide to the Expression of Uncertainty in Measurements (GUM) to Building Systems Engineering
Ralph Muehleisen, Ph.D., P.E., Member, Illinois Institute of Technology, Chicago, IL
2. The Uncertain Nature of Measured Ratings of Building Components and Equipment
William M. Healy, Ph.D., Member, National Institute of Standards and Technology, Gaithersburg, MD

Seminar 53 (Intermediate)

Sustainable Large Office Building Design and Commissioning

Track: Large Building Systems

Sponsor: 9.8 Large Building Air-Conditioning Applications, 7.6 Systems Energy Utilization, 7.9 Building Commissioning, 9.1 Large Building Air-Conditioning Systems
Chair: John Harrod, P.E., Member, Benham Companies, Oklahoma City, OK

This program focuses on sustainable design concepts and commissioning of a large office building constructed and occupied by a large health insurance company. The building is anticipated to achieve LEED Gold certification and achieve 30% less energy consumption than ASHRAE Standard 90.1. The owner has also incorporated a continuous commissioning program into BAS and CMMS systems to assure the building maintains its low energy consumption status through its lifetime.

1. Design and Commissioning of a LEED Gold Large Office Building
Robert L. Cox, P.E., Member, Jacobs Engineering, Cary, NC
2. Development and Implementation of a Continuous Commissioning Program for a Large LEED Gold Office Building
Michael Patrick, P.E., Member, Blue Cross Blue Shield of North Carolina, Chapel Hill, NC

Forum 12 (Intermediate)

Do We Need an Air Filter Energy Usage and/or Life Cycle Cost Guideline for HVAC Air Filters?

Track: Fundamentals

Sponsor: 2.4 Particulate Air Contaminants and Particulate Contaminant Removal Equipment
Chair: Monroe A. Britt, Member, Green Leaf Technologies, Finchville, KY

To insure optimal air quality management, the energy usage and service life of air filters must be considered. At present, the air filter industry does not have a standard or guideline to uniformly evaluate the service life and/or operating energy usage of air filters. Filter efficiency, initial and final pressure drops, and dust holding capacity must all be parameters that guide the users in proper air filter selections. The participants of this forum can provide significant input in the development of a guideline to uniformly and properly evaluate and selection filters for various applications. Current plans are to use the information gathered to serve as a basis for a new standard or guideline.

Forum 13 (Basic)

Optimal Humidity Levels for Indoor Air Quality

Track: Applications

Sponsor: 5.11 Humidifying Equipment, 2.1 Physiology and Human Environment
Chair: Eric Brodsky, P.E., Member, Research Products Corp., Madison, WI

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 impacts occupant comfort and overall indoor air quality. This forum discusses the engineering need for defining optimum humidity specifications in buildings.

Forum 14 (Intermediate)

What Is the Future of Hydronics?

Track: Applications

Sponsor: 6.1 Hydronic and Steam Equipment and Systems
Chair: William Coad, P.E., Presidential Fellow Life Member, Coad Engineering Enterprises, St. Louis, MO

The forum explores the future of hydronic heating and cooling applications as they relate to energy conservation, indoor environmental quality and life cycle costs. We seek to find out if hydronic systems will be relevant in future HVAC designs. Will dedicated outdoor air systems maximizing indoor air quality move from hydronic-based systems to packaged gas-fired rooftop units to be more cost effective? Will hydronic heating systems follow steam out the door in favor of energy efficient decentralized ground source all electric heat pumps? TC 6.1 is seeking feedback in focusing future research, Handbook additions and seminars relating to hydronic heating and cooling system equipment and applications.

Forum 15 (Basic)

Building Information Modeling: ASHRAE's Role

Track: Applications

Sponsor: BIM Steering Committee, 1.5 Computer Applications
Chair: Charles E. Gulledge, III, P.E., Member, AC Corp., Greensboro, NC

This forum seeks input related to ASHRAE's potential development of targeted resources to promote development and utilization of Building Information Models in Integrated Project Delivery. Feedback is desired to structure content for an ASHRAE BIM User's Guide, white papers, transactions, Handbook content, seminars, Journal articles, short course material, special publications and reference material.

WEDNESDAY, 6/24 11 A.M.–12:30 P.M.

Transactions 20 (Intermediate)

Design Guides for Improving Energy Performance and Indoor Air Quality of Military Buildings

Track: Sustainability/LEED

Sponsor: 7.6 Systems Energy Utilization, 2.8 Building Environmental Impacts and Sustainability
Chair: Gregory B. Stark, P.E., Member, National Renewable Energy Lab, Golden, CO

The Energy Policy Act of 2005 requires that all new federal facilities be built to achieve 30% energy savings over Standard 90.1-2004. The Army Corps of Engineers along with ASHRAE and the National Renewable Energy Laboratory developed target energy budgets and energy design guides with prescriptive paths for achieving the energy savings for all climate zones for eight building types. This information is included in their requests for proposals for new construction. This transactions session covers the development and implementation of the design guides for barracks, maintenance facilities and dining facilities.

1. Energy Design Guides for Army Barracks (LO-09-093)
Dale Herron, Member, U.S. Army Corps of Engineers, Champaign, IL
2. Achieving Energy Efficiency and Improving Indoor Air Quality in Army Maintenance Facilities (LO-09-094)
Alexander Zhivov, Ph.D., Member, U.S. Army Corps of Engineers, Champaign, IL
3. Improving Energy Performance of Army Dining Facilities (LO-09-095)
Michael Deru, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

Seminar 54 (Intermediate)

Optimal Air Quality: Control of Ozone

Track: Indoor Air Quality

Sponsor: 62.1
Chair: Matthew C. Middlebrooks, Member, Filtration Group, Inc., York, SC

Ozone and its health affects on building occupants continue to grab attention in the press, with continued downward pressure on acceptable levels. But, in some locations ventilating with outside air can make the problem worse. So what can you do? This seminar presents information on various removal technologies and strategies and how they can be incorporated into an overall ventilation plan, especially with regards to compliance with ASHRAE 62.1-2007.

1. Ozone: Presence and Prevention in Buildings
Mark Stutman, Member, Camfil Farr, Inc, Riverdale, NJ
2. Ozone Removal for Passively and Mechanically Ventilated Buildings
Jeffrey Siegel, Member, University of Texas at Austin, Austin, TX
3. Ozone Mitigation with UV and UVPCO (UV Photocatalytic Oxidation)
Steve Hay, United Technologies Research Center, East Hartford, CT
4. Complying with ASHRAE 62.1-2007: Section 6.2.1.2 – Ozone
Chris Muller, Member, Purafil, Inc., Doraville, GA

The Technical Program will be updated, when necessary, at www.ashrae.org/louisville

Seminar 55 (Intermediate)

Sustainable Cooling Systems Using Thermal Energy Storage

Track: Sustainability/LEED

Sponsor: 6.9 Thermal Storage
Chair: Alan Green, P.E., Member, CBI, Plainfield, IL

Thermal energy storage (TES) was originally developed as a load shifting technology to avoid peak demand costs and economize on capital costs. However, TES has applications beyond shifting of electrical loads in conventional chiller plants. This seminar explores several unique applications for TES in conjunction with sustainable cooling systems.

1. Deep Lake and Sea Water Cooling with TES
John Andrepont, Member, Cool Solutions Co., Naperville, IL
2. Energy Recovery and TES
Mark MacCracken, P.E., Member, CALMAC Manufacturing Corp, Englewood, NJ
3. Case Study of Loma Linda U System
Lucas Hyman, P.E., Member, Goss Engineering, Corona, CA

Seminar 56 (Intermediate)

Building Enclosure Design for Special-Use Buildings: High Humidity, Low Temperature and Mixed-Use Facilities

Track: Applications

Sponsor: 4.4 Building Materials and Building Envelope Performance
Chair: Andreas Holm, Ph.D., Fraunhofer-Institut Bauphysik, Vallely, Germany

Special-use buildings, such as indoor swimming pools, museums, ice rinks, and cold storage facilities, are often designed in a manner similar to offices, schools, and condominiums. However, the unique indoor environments in these buildings, which may include high or low temperatures, high relative humidity levels, and positive or negative air pressures, demand a much more robust enclosure capable of dealing with these conditions. This seminar describes the unique challenges associated with high humidity, low temperature, and mixed-use buildings, drawing on the presenters' theoretical background as well as their practical experience. Case studies illustrate design strategies and problems in real buildings.

1. Solving Moisture Problems of Cool and Humid Storage Buildings by Managing Seasonal Vapor Flow
Hartwig Kuenzel, Member, Fraunhofer-Institut Bauphysik, Vallely, Germany
2. Preventing Building Enclosure Problems in Indoor Swimming Pools
Hugo Hens, Ph.D., Fellow, K.U. Leuven, Leuven, Belgium
3. Moisture Control in Mixed-Use Buildings
Paul Shipp, P.E., Ph.D., Member, WSG Corp., Libertyville, IL

Seminar 57 (Advanced)

Systems with Natural Refrigerants: Components and Field Experience

Track: Refrigeration

Sponsor: Refrigeration Committee, 3.1 Refrigerants and Secondary Coolants, 8.1 Positive Displacement Compressors, 10.7 Commercial Food and Beverage Cooling Display and Storage
Chair: Georgi Kazachki, Ph.D., Fellow ASHRAE, DRS Technologies, Florence, KY

A variety of refrigerating and air-conditioning systems in the entire range of sizes and applications were developed in the last decade using partially or completely non-halocarbon refrigerants which in most instances were referred to as natural refrigerants. Intensive R&D efforts were devoted to systems with CO_2 as the refrigerant or secondary coolant, either as a single working fluid or pared with other refrigerants, such as NH_3, hydrocarbons, and halocarbons. This seminar provides advanced information on design aspects, laboratory evaluation, and filed monitoring and evaluation in three representative applications: residential, commercial and industrial.

1. Commercial Applications for CO_2
David Hinde, Member, Hill PHOENIX, Covington, GA
2. Field Monitoring and Evaluation of a Large CO_2/NH_3 Refrigeration System
Ryan Hoest, Member, VACOM Technologies, San Luis Obispo, CA
3. Mechanical and Thermal Aspects of CO_2/NH_3 Cascade Condensers
Zahid Ayub, Ph.D., P.E., Fellow ASHRAE, Isotherm, Inc., Arlington, TX
4. Performance of CO_2 Heat Pump Water Heater
Yunho Hwang, Ph.D., Member, University of Maryland, College Park, MD

Seminar 58 (Intermediate)

Impact of Controls for LEED and Green Buildings for Optimum Indoor Environments

Track: Sustainability/LEED

Sponsor: 1.4 Control Theory and Application, 7.3 Operation and Maintenance Management
Chair: James W. Gartner, Member, Consultant, Cincinnati, OH

The interest in green buildings continues to increase with the current rising U.S. and global environmental concerns, including indoor health and our planet's climate change alarms. How can we best address these sometimes conflicting goals to achieve the highest LEED and green building design objectives, up to zero net energy buildings? More importantly, how can we monitor and maintain optimum human comfort, productivity and sustain minimal environmental impact? This seminar intends to provide insight on the key role our HVAC controls play in optimum facility performance.

1. How DDC Controls Can Keep Your LEED Building Green: Technical vs. Human
Larry Fisher, Member, ECT Services, Louisville, KY
2. A Facility Manager's Overview: Before and After the Building was LEED Gold Certified
Clay Nesler, Member, Johnson Controls, Milwaukee, WI
3. Energy Optimal Green Building Controls: R&D
Gregory Dobbs, Member, United Technologies, East Hartford, CT

Seminar 59 (Intermediate)

Using Cx to Improve Sustainability and IAQ of Existing Buildings

Track: Operational Topics

Sponsor: 7.9 Building Commissioning
Chair: Sarah E. Maston, P.E., Member, RDK Engineers, Andover, MA

In these case studies, the importance of commissioning and the role it plays in the increasing of sustainability and IAQ in existing buildings is investigated.

1. Using Cx to Manage IAQ and ATC for Two Existing Building Renovations on their Way to LEED
Joseph R. Anderson, P.E., Member, Anderson Engineering, LLC, Germantown, TN
2. Factors that Affect IAQ and the Lifespan of New and Existing Buildings
Harry J. Enck, Associate Member, Commissioning & Green Building Solutions, Inc., Buford, GA
3. Cx and the Three Builders: Bob the Builder, Joe Bob the Builder, and Robert Builders Inc.
Charles R. Snowden, P.E., Associate Member, Bureau of Building, Grounds, and Real Estate Property Management, Jackson, MS

Seminar 60 (Intermediate)

Should There Be Regional Energy Efficiency Standards for Residential and Light Commercial Air Conditioners and Heat Pumps?

Track: Systems and Equipment

Sponsor: 8.11 Unitary and Room Air Conditioners and Heat Pumps, 6.3 Central Forced Air Heating and Cooling Systems
Chair: Raymond Rite, Ph.D., Trane, Tyler, TX

This seminar presents the perceived deficiencies in the standard rating methods from a climate as well as component basis and make some suggestions on things to consider when developing new standards to reflect these realities. Can this be done without needlessly complicating the ratings landscape, and if so, what would it look like? Both residential split systems as well as light commercial packaged systems are addressed.

1. The Case for Regional Energy Efficiency Standards for Residential Air Conditioners and Heat Pumps
Harvey Sachs, Ph.D., ACEEE, Washington, DC
2. Up on the Roof: From the Past to the Future
Reid Hart, PECI, Portland, OR
3. Standards and Innovation: Can Regional Standards Promote Holistic Improvements in Energy Systems?
Ram Narayanamurthy, PVTSOLAR, Berkeley, CA
4. Climate Zone Impacts on Heating Season Performance
Paul Francisco, University of Illinois, Urbana, IL

ASHRAE LEARNING INSTITUTE

2009 Annual Conference Education Program

The ASHRAE Learning Institute will offer two Professional Development Seminars and four Short Courses during the Annual Conference.

The ALI is approved by The Practicing Institute of Engineering, Inc. (PIE) to provide seminars and courses for New York state's mandatory education requirements for professional engineers. Most courses carry continuing education units (CEUs) and/or professional development hours (PDHs), which can be applied toward maintaining P.E. registration.

Please visit www.ASHRAE.org/louisvillecourses for complete course descriptions and to register.

FULL-DAY PROFESSIONAL DEVELOPMENT SEMINARS

Registration fees: $395 for ASHRAE members; $485 for non-members
Completion of each course earns 6 PDHs/AIA LUs or .6 CEUs

Course: **Using Standard 90.1 to Meet LEED and Federal Tax Credit Requirements (Formerly Exceeding Standard 90.1-2007)**
Date: Saturday, June 20
Time: 8 a.m.–3 p.m.
Instructor: McHenry Wallace, P.E. (TXU Energy) & Joseph Deringer, AIA (Institute for the Sustainable Performance of Buildings)

Course: **Data Center Energy Efficiency (New!)**
Date: Saturday, June 20
Time: 8 a.m.–3 p.m.
Instructors: Dr. Roger Schmidt, P.E. (IBM), Don Beaty, P.E. (DLB Associates), & Jack Glass, P.E. (Citigroup)

HALF-DAY SHORT COURSES

Registration fees: $115 for ASHRAE members; $149 for non-members
Completion of each course earns 3 PDHs/AIA LUs or .3 CEUs

Course: **Engineering for Sustainability: Understanding Air-to-Air Energy Recovery Technology and Applications (New!)**
Date: Sunday, June 21
Time: 2:30 p.m.–5:30 p.m.
Instructor: Paul Pieper, P.Eng (Venmar CES Inc.)

Course: **Low Temperature Radiant Heating & High Temperature Radiant Cooling Systems**
Date: Monday, June 22
Time: 2:30 p.m.–5:30 p.m.
Instructor: Bjarne Olesen, Ph.D. (Technical University of Denmark)

Course: **The Commissioning Process & Guideline 0**
Date: Monday, June 22
Time: 2:30 p.m.–5:30 p.m.
Instructor: Walter Grondzik, P.E. (Ball State University)

Course: **Understanding Standard 189.1P for High Performance Green Buildings**
Date: Tuesday, June 23
Time: 2 p.m.–5 p.m.
Instructor: Tom Lawrence, P.E. (University of Georgia)

The Technical Program will be updated, when necessary, at www.ashrae.org/louisville