= program is being submitted for approval for AIA LUs, NY PDHs and USGBC LEED AP credits.

Sunday, June 27
8:00 A.M.-9:30 A.M.

Sunday, June 27, 2010, 8:00 AM-9:30 AM

Conference Paper Session 1 (Advanced)

Design Applications for Sustainable Buildings

Track: Energy Facts vs. Simulation
Room: Cimarron
Chair: Steve Cornick, P.Eng., National Research Council Canada, Ottawa, ON, Canada

This session will provide an overview of methods and system modification to help us look at ways to reduce the energy used in buildings.

1. Predicting Condensate Collection from HVAC Air Handling Units (AB-10-C001)
T.M. Lawrence, Ph.D., Member*, Jason Perry, Associate Member and Peter Dempsey, Student Member, University of Georgia, Athens, GA*

This paper presents a methodology for predicting the amount of water collected from an air handling unit. The prediction model could be used to estimate the water collected for either a retrofit or new construction scenario. Data taken during the 2009 cooling season on a 100% outdoor air unit were used to validate a model for the amount of condensate collected. Results indicate that it is possible to predict the amount of condensate, but the accuracy of the prediction strongly depends on the accuracy of the relative humidity sensors used.

2. Carbon Neutral Design Based On Native-Site Carbon Storage (AB-10-C002)
Michael Bendewald, Student Member *and Victor Olgyay, Member, Rocky Mountain Institute, Boulder, CO*

A certain amount of emphasis has been placed on carbon neutral design lately in the buildings industry. The emphasis has thus far been on building operation emissions and to a certain degree the embodied emissions of construction. In response to this increased interest in carbon neutrality, this paper discusses alternative approaches to carbon neutrality and introduces a new definition.

3. Delivering Sustainability Promise to HVAC Air Filtration (AB-10-C003)
Christine Sun, Ph.D., Member*, Freudenberg Nonwovens, Hopkinsville, KY*

How should we deliver such sustainability promises to air filtration in HVAC systems? This paper is the second part of a continuous research to discuss sustainability of the air filters along their service using life cycle cost analysis. The demonstration is based on a real case study of an air handling unit (AHU) of a commercial building. An in-depth study on filter design, media structure and dust loading morphology will be presented at the end to better understand a sustainable design for air filters.

Sunday, June 27, 2010, 8:00 AM-9:30 AM

Seminar 1 (Intermediate)

BIM Implementation from an Industry-Wide Perspective

Track: Professional Skills
Room: San Miguel
Sponsor: 07.01 Integrated Building Design, BIM Steering Committee
Chair: Christopher Wilkins, Member, Hallam-ICS, So. Burlington, VT

This session includes speakers from outside of ASHRAE who can offer a wider perspective on the use and implementation of BIM in the boader building industry. It includes speakers from buildingSMART Alliance, AIA and GSA. The intent is to show ASHRAE members how their area of BIM fits in with other BIM activities in other areas of the industry.

1. buildingSMART Alliance
Dana K. (Deke) Smith*, buildingSMART Alliance, Washington, DC*

This presentation will discuss the importance of establishing national and international standards in order to accomplish open BIM Standards. The foundation being built through the partnership with ASHRAE is critical to establishing information interoperability from the inception of a project onward.

2. American Institute of Architects
Markku Allison*, American Institute of Architects, Washington, DC*

This session will present the industry implementation of BIM from the perspective of the architectural industry. The primary learning objective will be to show ASHRAE members how their BIM efforts mesh with the architects.

3. General Services Administration
Martin Weiland, Member*, General Services Administration, Washington, DC*

GSA is one of the world's largest building owners. They have been pioneers in developing BIM as a building owner's tool to add value to their enterprise. This presentation shows ASHRAE members how their efforts can focus on areas to deliver value to building owners.

Sunday, June 27, 2010, 8:00 AM-9:30 AM

Seminar 2 (Basic)

Building Energy Simulation 101

Track: Energy Facts vs. Simulation
Room: Brazos
Sponsor: 04.07 Energy Calculations
Chair: Timothy McDowell, Thermal Energy System Specialists, LLC, Madison, WI

With the growing focus on energy conservation and building rating systems, there has been an increase in the required usage of building energy simulation. But what does building energy modeling mean for your practice and how do you go about getting started? This seminar will cover the basics from what are the different types of simulation programs and how you select the appropriate type to what information you need to model the building and the HVAC system.

1. Bringing Energy Simulation Into Your Office
Erik Kolderup, P.E., Member*, Kolderup Consulting, San Francisco, CA*

Building energy simulation programs, their appropriate uses and how they can be integrated into your office. Real world examples show how firms have brought this expertise into their practices. Pros and cons of alternative approaches are also presented.

2. Quickstart Guide to Building Energy Modeling
Charles S. Barnaby, Member*, Wrightsoft Corporation, Lexington, MA*

What information do you need to model a building? This talk is a tour through the basics, including building geometry, construction, fenestration, internal gains, zoning, and weather data. Available building simulation applications handle these aspects in various ways. Understanding underlying principles helps you get meaningful modeling results.

3. HVAC Equipment and System Simulation Basics
Gren Yuill, Ph.D., Member*, University of Nebraska - Lincoln, Omaha, NE*

The next piece of the puzzle is the model of the HVAC system for the building. This talk will cover how the different HVAC system types are modeled and the information that you need to gather in order to describe the system for building energy simulation.

Sunday, June 27, 2010, 8:00 AM-9:30 AM

Seminar 3 (Intermediate)

Cap & Trade: Impact on Buildings and Operating Costs

Track: Living with HVAC&R Systems
Room: Ruidoso
Sponsor: 07.08 Owning and Operating Costs, 01.09 Electrical Systems
Chair: Bruce B. Lindsay, P.E., Member, Johnson Controls Inc., Madison, WI

Cap & Trade regulations on CO2 and other greenhouse gases will impact the cost of electricity and influence the design and operation of buildings and HVAC equipment. Utilities, HVAC manufacturers, and large building owners are assessing multiple scenarios that may require major investments and risk mitigation strategies. A representative from each of the stakeholders share their unique perspective on Cap & Trade.

1. A Utility Perspective on Cap & Trade
Steve Rosenstock, Member*, Edison Electric Institute, Washington, DC*

Greenhouse gas regulations, whether from legislation or from a rulemaking by the US Environmental Protection Agency, will have a significant impact on how electric utilities generate power in the future, and could have a significant impact on future electric bills and the owning and operating costs of HVAC equipment. There could also be a significant role played by increasing energy efficiency in buildings, if utilities are allowed to use efficiency to meet some of their obligations. Presented is a perspective of the utilities that belong to the Edison Electric Institute, the trade association of investor-owned electric and combination electric/gas utilities.

2. An HVAC Manufacturer's Perspective on Cap & Trade
Clay Nesler, Member*, Johnson Controls, Milwaukee, WI*

A number of competing market-based approaches (e.g., cap & trade, carbon tax) have been proposed as a means to reduce greenhouse gas emissions at the lowest cost. Without comprehensive national legislation, states and regions are putting in place their own programs while the EPA stands ready to regulate emissions using command-and-control approaches if necessary. Many proposed approaches include complementary policies including stricter building codes, appliance standards, building performance labeling and incentives for retrofitting existing buildings. This presentation reviews the impact that current and proposed legislation will have on the HVAC manufacturing industry and the markets they serve.

3. The Indirect Effects of Cap & Trade on Building Owners
Stephen Starbuck*, Ernst & Young, Washington, DC*

A significant but hidden component of businesses' total energy consumption is the “indirect” energy consumption that occurs as businesses purchase goods and services from other businesses that consume carbon-based energy. This presentation will discuss estimates of the costs, in terms of both direct and indirect effects, of a generic emissions pricing system that would apply to greenhouse gas emitting activities including transportation, manufacturing and electricity generation. Under this approach to reducing green house gas emissions, the market value of the emission allowances serve as a “tax” that increases the cost of business inputs and final consumer products and services.

Sunday, June 27, 2010, 8:00 AM-9:30 AM

Seminar 4 (Intermediate)

Data Center Heat Rejection at Altitude by Evaporative Cooling

Track: High Efficiency HVAC Systems
Room: Mesilla
Sponsor: 09.09 Mission Critical Facilities, Technology Spaces and Electronic Equipment
Chair: Clifford M. (Mike) Scofield, P.E., Fellow ASHRAE, Conservation Mechanical Systems, Sebastopol,, CA

This seminar examines methods of using ambient wet bulb (WB) conditions for hot aisle heat rejection to improve data center power usage effectiveness (PUE). Sites located at elevation enjoy lower ambient vapor pressures which improve evaporative cooling efficiency. This is in direct contrast to air cooled

refrigeration condensing heat rejection designs for data centers which must be derated due to reduced air density at altitude. As we "move up the mountain", the wet bulb depression (Ambient Dry Bulb-WB) increases at summer design conditions. This increase yields a greater opportunity for heat rejection to the WB temperature when electrical energy costs are at their highest.

1. Reduce Data Center PUE Utilizing Cooling Towers in the Free Cooling Mode
Daryn S. Cline, Member*, EVAPCO, Inc., Taneytown, MD*

Data centers consume approximately 2% of the electrical power generated in the U.S. today. To control this increasing power demand, a recent shift to higher data center ambient temperatures provides the data center user/operator with the ability to save energy by utilizing evaporative free cooling for extended periods during the year. Organizations such as the GreenGrid have developed free cooling PUE calculators to help data center operators improve their energy efficiency by free cooling. This presentation discusses and shows examples of how the data center PUE can be dramatically reduced utilizing evaporative free cooling with cooling tower technology.

2. The "Indirect" Air-Side Economizer Cycle: A Winning Strategy for the Rejection of Data Center Heat
Keith Dunnavant, P.E., Member*, Munters/Des Champs Laboratories, Buena Vista, VA*

This presentation discusses a new method for data center heat rejection termed the "Indirect" Air-Side Economizer (IASE). This hybrid strategy has elements of air-side and water-side economizers, and rejects data center heat to outdoor air, by way of an air-to-air heat exchanger. The presentation provides details and performance of various design strategies based on plate-type, heat pipe, and polymer tube type heat exchangers, with and without evaporative cooling assist. The presentation provides detailed annual operation analysis and explains how this new heat rejection strategy may be implemented into data center architectural schemes.

3. Water Treatment for Evaporative Cooling
Sarah Ferrari, Associate Member*, EVAPCO Inc., Taneytown, MD*

This presentation will discuss the methods and issues associated water treatment for direct and indirect evaporative cooling for data centers.

Sunday, June 27, 2010, 8:00 AM-9:30 AM

Seminar 5 (Intermediate)

Healthcare Facilities Can Use Less Energy. No Kidding.

Track: High Efficiency HVAC Systems
Room: Aztec
Sponsor: 09.06 Healthcare Facilities
Chair: Shanti Pless, Member, National Renewable Energy Laboratory, Golden, CO

Healthcare facilities have unique and challenges for their HVAC systems. HVAC design criteria for health care facilities vary as much as the medical services provided. The criteria for a hospital operating 24/7, with patients who are incapable of self-preservation, are very different than those for a outpatient medical office. Up until recently health care facilities were exempt from energy conservation codes. Presenters demonstrate energy saving strategies that meet the unique challenges while supporting patient outcomes.

1. Standard 90.1 – 2004, 2007, 2010 Impacts On Healthcare Facility Design
Jeff Boldt, P.E., Member*, KJWW Engineering Consultants, Madison, WI*

What requirements will be added in the 2010 edition of 90.1, the most adopted energy code on the planet? 90.1 was challenged by DOE to achieve 30% savings in the 2010 edition when compared to buildings complying with the 2004 edition. This required huge changes to the standard. Over 80 significant changes have been approved since 90.1-2007 was published. This presentation concentrates on the changes that will have the most significant impact on the construction of healthcare facilities, e.g. no more CAV hospitals!

2. Reductions at Partners Health Care System Using Unoccupied Control and Heat Recovery Chillers
Robert Cox, P.E.*, Jacobs Carter Burgess, Cary, NC*

This presentation features the results of the estimated reduction in energy consumption at Partners Healthcare Facilities. A Strategic Energy Master Plan was prepared for Partners Health Care Systems to achieve at least a 25% reduction in energy consumption with less than a 6 year simple payback. Several energy conservation strategies were used including use of variable volume control, unoccupied period modifications to minimum airflow requirements, and use of heat recovery chiller heat pumps. The recommended projects are projected to reduce energy consumption by more than $16 million annually and save over 28% of annual energy consumption.

3. Case Studies: Examples of High Performance Healthcare Facilities throughout the USA Climate Zones
Michael Meteyer, P.E., Member*, Cogdell Spencer ERDMAN, Madison, WI*

See examples of newly constructed medical facilities that significantly out perform the energy code in various climate zones. Information on how they achieved these energy savings, their actual energy use, and other key facts are presented. Learn how to apply these ideas and lower the energy use in your next healthcare project.

Sunday, June 27, 2010, 8:00 AM-9:30 AM

Seminar 6 (Basic)

Standard 100 Revision Overview

Track: Energy Conservation vs. New Generation
Room: Galisteo
Sponsor: 07.06 Systems Energy Utilization, SPC 100
Chair: Michele Friedrich, P.E., Member, PECI, Portland, OR

ASHRAE is in the process of revising Standard 100 Energy Efficiency of Existing Buildings. The draft of the standard is targeted to be completed in 2010. The revised standard has performance requirements for existing buildings that compare the current building Energy Use Intensity with target Energy Use Intensity that is given in the standard. The standard also has mandatory Operation and Maintenance section. Standard 100 provides the process to make an existing building energy efficient and keep it that way. This seminar covers an overview of the draft standard and each of the sections.

1. Standard 100 Energy Efficiency in Existing Buildings Revision
Michele Friedrich, P.E., Member*, PECI, Portland, OR*

This presentation will provide an overview of the revision of ANSI/ASHRAE/IESNA Standard 100 Energy Efficiency in Existing Buildings. The revised standard is performance based with target Energy Use Intensities (EUI) for many commercial and residential buildings. An alternative path is given for buildings for which there is no target. This presentation will cover the compliance path and outline for the standard.

2. Operations and Maintenance in Standard 100
Cedric Trueman, P.Eng., Life Member*, Trueman Engineering Services, Victoria, BC, Canada*

This presentation will provide an outline of the operations and maintenance requirements that are being proposed for inclusion in the revised Standard 100. These requirements will have to be met in order for a building to comply with the standard. The proposed requirements include continuous monitoring of building energy performance, operational practices that will lead to improving energy efficiency of existing building systems, and the development and implementation of a preventive maintenance program covering all building systems.

3. Building Energy Use Intensity Targets for the Standard 100 Update
Terry Sharp, P.E.*, ORNL, Oakridge, TN*

The development strategies for the energy use intensity baselines for 48 commercial building types and the derivation of energy performance targets from each will be discussed. These performance targets have been developed for the upcoming update of ANSI/ASHRAE/IESNA Standard 100. Building energy performance targets are a new addition to Standard 100.

4. Audits, Implementation and Verification in Standard 100
Dennis Landsberg, Ph.D., Member, *L&S Energy Services, Inc., Clifton Park, NY*

An overview of Sections 7 and 8 of Standard 100R. These include energy audits, implementation and verification. Presentation will include performance of audits, implementation plan and verification for buildings with a target Energy Use Intensity (EUI) and buildings for which a target EUI does not exist.

Sunday, June 27, 2010, 8:00 AM-9:30 AM

Seminar 7 (Intermediate)

Commissioning Mission Critical Data Centers

Track: Data Center and High Density Cooling
Room: Dona Ana
Sponsor: 07.09 Building Commissioning, 09.09 Mission Critical Facilities, Technology Spaces and Electronic Equipment
Chair: Roger Lautz, P.E., Member, Affiliated Engineers, Brookfield, WI

Reliability-centered commissioning service is crucial to avoid down-time and to maintain energy efficiency for mission critical data center facilities. The unique challenges of commissioning, re-commissioning and retro-commissioning data centers and other mission critical facilities are addressed.

1. Reliability-Centered Commissioning Service for Mission Critical Data Center Facilities
Yanzheng (Don) Guan, Ph.D., P.E., *Reliatech, Reston, VA*

Even though a not frequently discussed topic, reliability-centered commissioning service is crucial to avoid down-time and to maintain energy efficiency for mission critical data center facilities. The unique challenges of commissioning, re-commissioning and retro-commissioning data centers and other mission critical facilities will be addressed in the seminar. Additionally, in an effort to incorporate commissioning as part of the sustainable project delivery process, we are developing an innovative “paperless” commissioning technology, which could eliminate much of the paper-intensive process and integrate commissioning with data center facility service and management.

2. Data vs. Dorm: Mission Critical Data Centers and Residential Hall LEED Gold Case Studies
James Vallort, P.E., Member, *Environmental Systems Design, Chicago, IL*

In our experience, the commissioning process for a residential hall that is pursuing LEED Gold status presents a set of issues that are surprisingly similar to the issues raised in the process of commissioning a mission critical data center. While implementation is customized to each application, a solid commissioning process can be applied to both. A case study of commissioning for a data center and a residence hall will be presented highlighting the common process steps and resulting benefits for each facilities unique use.

Sunday, June 27
9:45 A.M.-10:45 A.M.

Sunday, June 27, 2010, 9:45 AM-10:45 AM

Technical Plenary 1 (Basic)

Standard 90.1: Past, Present and Future

Track: Energy Conservation vs. New Generation
Room: Brazos
Sponsor: Conferences and Expositions Committee
Chair: M. Ginger Scoggins, PE, Member, Engineered Designs Inc., Raleigh, NC

This session will review the history and progress of Standard 90.1 in celebration of the Standard's 35th anniversary.
Ronald Jarnagin, Member, *Pacific Northwest National Laboratory, Richland, WA*

Sunday, June 27
11:00 A.M.-12:30 P.M.

Sunday, June 27, 2010, 11:00 AM-12:30 PM

Technical Paper Session 1 (Basic)

Leakage and Pressure Loss Measurements in Duct Systems

Track: Ventilation Systems
Room: Ruidoso
Sponsor: 05.02 Duct Design
Chair: Stephen Idem, Ph.D., Member, Tennessee Tech University, Cookeville, TN

The influence of test section entrance conditions on straight flat oval duct apparent relative roughness was studied. The apparent relative roughness obtained using a test setup in compliance with Standard 120 was considerably lower than the value of relative roughness obtained with a test setup that did not conform to the standard. Experiments were performed to determine the absolute roughness of three corrugated circular spiral ducts. Pressure loss predictions for corrugated and standard spiral ducts are compared. Measurements to determine the leakage class for three cross sections of sealed and unsealed flat oval ducts under positive and negative internal pressures were conducted. The leakage data were found to be a power law function of static pressure difference between the interior and the exterior of the duct.

1. Influence of Test Section Entrance Conditions On Straight Flat Oval Duct Apparent Relative Roughness (AB-10-001)
***Swapnil Khaire**, Tennessee Tech University, Cookeville, TN*

An experimental program was initiated to study the influence of test section entrance conditions on straight flat oval duct apparent relative roughness. The apparent relative roughness obtained using a test setup in compliance with Standard 120 was considerably lower than the value of relative roughness obtained with a test setup that did not conform to the standard.

2. Measured and Predicted Pressure Loss in Corrugated Spiral Duct (AB-10-002)
***Daniel Gibbs, Associate Member**, Barge Waggoner Sumner & Cannon, Inc., Nashville, TN*

An experimental program was initiated to determine the absolute roughness of three corrugated circular spiral ducts. Pressure loss tests were likewise performed on a round standard spiral seam duct using Pitot-static tubes mounted at the duct centerline, and also using wall static pressure taps mounted on the duct surface at identical axial locations. The absolute roughness values obtained by these two approaches were indistinguishable. Pressure loss predictions for corrugated and standard spiral ducts are compared.

3. Flat Oval Duct Leakage Class Measurement (AB-10-003)
***Stephen Idem, Ph.D., Member**, Tennessee Tech University, Cookeville, TN*

This paper presents results of an experimental program to determine the leakage class for three cross section flat oval ducts for positive and negative internal pressures. Sealed and unsealed duct leakage tests were performed. The leakage data were found to be a power law function of static pressure difference between the interior and the exterior of the duct.

Sunday, June 27, 2010, 11:00 AM-12:30 PM

Conference Paper Session 2 (Advanced)

Standard 62.1-2010 Update and Application Considerations

Track: Ventilation Systems
Room: Mesilla
Chair: Ben Leppard, Member, Leppard Johnson & Associates, Tucker, GA

This session addresses several current issues in ventilation air applications and the latest ASHRAE Standard, to include the following: optimization of supply air temperature, related to ASHRAE Standard 62; natural ventilation application in a university building; dynamic reset approaches for VAV systems; new requirements of ASHRAE Standard 62.1-2010; and reduction of errors in ventilation rate determination and control.

1. Optimizing Supply Air Temperature with ASHRAE 62.1 (AB-10-C004)
***Abdel Kader Darwich, Member**[1] and Samivullah Shaik, Member[2], (1)Guttmann and Blaevoet, Sacramento, CA, (2)Saudi Consolidated Engineering Company, Al-Khobar, Saudi Arabia*

This discussion will present the derivations and the resulting expressions obtained for the total power and the life cycle cost in any system with respect to the supply air temperature. Moreover, the result obtained by using MATHEMATICA to differentiate these expressions to obtain the optimum supply temperature for either minimum power or minimum life cycle cost will be discussed. The resulting equations are complicated in nature. However, they were programmed into a spreadsheet that will able to indicate to the designer the optimum supply temperature based on all of the above inputs.

2. Assessments of the Natural Ventilation Function in a University Building Using Experimental Techniques (AB-10-C005)
***Salman Ilyas**[1], Ashley Emery, Fellow ASHRAE[2] and Dean Heerwagen[2], (1)Arup, Los Angeles, CA, (2)University of Washington, Seattle, WA*

The paper discusses the carbon dioxide concentrations, air velocities and the air change rates and their dependence upon specific room configuration, occupant behavior and environmental conditions. Accepting that high carbon dioxide concentrations are an indication of an unacceptable room environment, suggested strategies to reduce the concentrations and enhance the comfort are described.

3. New Requirements of ASHRAE 62.1-2010 (AB-10-C006)
***Hoy Bohanon, Member**, WorkingBuildings LLC, Winston Salem, NC*

There are several significant changes to ASHRAE Standard 62.1 Ventilation for Acceptable Indoor Air Quality between the 2007 version and the newly issued 2010 version including many changes that may impact energy use in buildings. Changes of in procedures include revisions to the IAQ procedure and the additional requirements for natural ventilation systems. The ventilation rate procedure for multiple zone systems (especially VAV systems) is clarified in a rewritten Appendix A. A section of the standard addressing demand control ventilation was added to clarify the circumstances when ventilation during operations can be reduced from the zone design ventilation rates.

4. Reduction of Errors in Ventilation Rate Determination (AB-10-C007)
***Leonard Damiano, Member**, EBTRON, Inc, Loris, SC*

Reduction of energy usage in mechanically ventilated buildings, without violating minimum dilution and pressurization requirements demands greater outdoor air control precision. Indirect methods of outdoor air rate determination may not be sufficient to satisfy the minimum ventilation, energy imperatives and concurrent requirements of ASHRAE Standards 62.1, 90.1 and 189.1. Direct methods of rate determination can minimize control uncertainties; improve air system repeatability and reliability. Design considerations and appropriate component selections provide the keys to a successful application of direct methods.

Sunday, June 27, 2010, 11:00 AM-12:30 PM

Seminar 8 (Intermediate)

BIM Load Calculations - Pain or Pleasure? A Case Study Involving the ASHRAE Headquarters Building

Track: Professional Skills
Room: San Miguel
Sponsor: 04.01 Load Calculation Data and Procedures, 04.07 Energy Calculations
Chair: Glenn Friedman, P.E., Member, Taylor Engineering, Alameda, CA

BIM, building information modeling, is a tool to enhance the efficiency of integrated building design including HVAC design. This seminar looks at two different attempts to create building HVAC load calculations using current BIM technology and exams the barriers and success. The ASHRAE Headquarters building is the example used in the Load Calculations Chapter of the ASHRAE Handbook. Since this example is published and sets a load calculation baseline for comparison, this same example is used for this seminar.

1. BIM to Load Example Using the ASHRAE Headquarters Building
***Steve Bruning, P.E., Fellow ASHRAE**, Newcomb & Boyd, Atlanta, Georgia*

This session looks at the experience of using one of the commercially available BIM software tools to perform a load calculation. It describes the method, the steps involved, the difficulties encountered and the outcome of this journey.

2. BIM Data Exchange for Loads: Understanding the Analytical Model
***Christopher Wilkins, P.E., Member**, Hallam-ICS, South Burlington, VT*

This session will describe the steps required to create an analytical model from an architectural model which is necessary to enable export of the architectural data in either gbXML or IFC format. A key learning objective is to define the difference between the architectural model and the analytical model and to make clear why the analytical model is needed. A specific example of export to a commercial load and energy program will be used to demonstrate this.

3. BIM Direct to Load
***Stephen Roth, P.E., Member**, Carmel Software, San Rafael, CA*

This session looks at the experience of using BIM to go directly to a load calculation. It describes the method, the steps involved, the difficulties encountered and the outcome of this journey.

Sunday, June 27, 2010, 11:00 AM-12:30 PM

Seminar 9 (Intermediate)

HVAC Equipment Needs for Net Zero Energy Homes

Track: Energy Conservation vs. New Generation
Room: Dona Ana
Sponsor: 08.11 Unitary and Room Air Conditioners and Heat Pumps
Chair: R. B. "Dutch" Uselton, P.E., Fellow ASHRAE, Lennox Industries Inc., Carrollton, TX

Homes of the future will be designed to use significantly less utility supplied energy. Changes to insulation, fenestration, infiltration and ventilation will have implications for the residential HVAC system of the future. These speakers share their views on what will be needed for homes of the future.

1. Low Energy Home Equipment Needs in a Range of U.S. Climates
Van Baxter, P.E., Member*, Buildings Integration Program, Oak Ridge National Laboratory, Oak Ridge, TN*

Presentation will discuss ZEH design characteristics and design/annual loads for the primary energy service needs of space conditioning and water heating. Two equipment approaches to meeting these needs are described 1) a conventional approach using an air source heat pump, electric water heater and stand-alone dehumidifier and 2) a conceptual integrated heat pump design. Equipment sizing needs peculiar to ZEH are discussed and a brief comparison of annual performance between the two equipment approaches are presented.

2. HVAC Loads in High Performance Homes
Dane Christensen, Ph.D., Member*, National Renewable Energy Laboratory, Golden, CO*

Advanced features, such as improved building enclosures, contribute significantly to energy conservation in high performing homes, largely via reduced space conditioning loads. What are the HVAC requirements in homes on the path to net zero energy?

3. Integrated Designs of Air Handling Systems Combining Renewable Generation and Minimal Energy Use
Ram Narayanamurthy, Member*, PVTSOLAR, Berkeley, CA*

Presenting information on design integration of air handling systems using nonrenewable energy generation.

Sunday, June 27, 2010, 11:00 AM-12:30 PM

Seminar 10 (Intermediate)

HVAC System Noise Control for Classrooms

Track: Living with HVAC&R Systems
Room: Brazos
Sponsor: 02.06 Sound and Vibration Control
Chair: Robert Lilkendey, Siebein Associates, Inc., Gainesville, FL

Controlling the noise produced by heating, ventilating and air-conditioning (HVAC) systems is essential to the quality of the listening environment in classrooms. This seminar summarizes the guidelines/requirements associated with the ANSI/ASA Classroom Acoustics (S12.60), LEED for Schools and others; describes case studies of different HVAC systems used to serve classrooms and acoustical design guidelines to meet the various standards; and presents the results of mock-up tests of common systems used in the Southwest and other areas demonstrating how to meet the ANSI S12.60 sound level requirement of 35 dBA or less for classrooms.

1. A Review of HVAC System Design Requirements in Current Classroom Acoustics Standards
Matthew T. Murello, P.E., Member*, Lewis S. Goodfriend & Associates, Whippany, NJ*

Since 2002 several standards have been promulgated regarding the acoustical design criteria for primary and secondary schools. This presentation provides a review of the current acoustical criteria established in the ANSI Classroom Acoustics Standard (S12.60-2002), LEED for Schools and the Collaborative for High Performance Schools (CHPS) guidelines. General acoustical design considerations for classrooms are also discussed and examples of each of the acoustical topics are presented. The presentation concludes by providing a partial list of the school districts that currently have adopted the acoustical standards.

2. Acoustical Design Guidelines for HVAC Systems in Schools
Robert Lilkendey*, Siebein Associates, Inc., Gainesville, FL*

Acoustical design guidelines for HVAC systems serving classrooms to meet the ANSI S12.60 Standard requirements will be presented, as well as case studies from real projects that illustrate the acoustical concepts.

3. Meeting the ANSI/ASA S12.60 Acoustic Limit for HVAC Noise in Classrooms
Stephen J. Lind, P.E.*, Trane, LaCrosse, WI*

This seminar will confirm via mock-up acoustical tests that the background noise level requirements of 35 dBA for HVAC systems serving core learning spaces contained in ANSI/ASA Standard S12.60, Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools can be met using HVAC systems commonly used in the southwestern United States following guidelines for acoustical design from the ASHRAE Handbook.

Sunday, June 27, 2010, 11:00 AM-12:30 PM

Seminar 11 (Intermediate)

IAQ Management through Use of Air Filtration

Track: Ventilation Systems
Room: Galisteo
Sponsor: 02.04 Particulate Air Contaminants and Particulate Contaminant Removal Equipment
Chair: Kyung-Ju Choi, Ph.D., Member, University of Louisville, Louisville, KY

Indoor air quality (IAQ) is defined as having the air be fresh and pleasant without having a negative impact on human health. Current standards and guidelines are based on the minimum IAQ requirement which can be maintained easily without making substantial modifications of system designs. IAQ management for commercial and industrial buildings as well as residential housings continues to be a major concern for both occupants and building engineers. This seminar focuses on air quality management through the use of particulate air filters.

1. Assessing IAQ Performance of Industrial Process Air Cleaning Equipment
Bob Burkhead, Member*, Blue Heaven Technology, Louisville, KY*

Assessing IAQ performance of industrial process air cleaning equipment - a new ASHRAE test method is born.

2. Particulate and Gaseous Contaminant Control for Improved Indoor Air Quality

***Charlie Seyffer**, Camfil, Riverdale, NJ*

Selecting particulate and gaseous air filters for target contaminants.

3. IAQ Management in Residential Building

***Thad Ptak, Ph.D., Member**, Columbus Industries, Columbus, OH*

Assessing indoor air quality in residential buildings.

Sunday, June 27, 2010, 11:00 AM-12:30 PM

Seminar 12 (Advanced)

Safe Ventilation for Clean Space in Healthcare Facilities

Track: Ventilation Systems
Room: Aztec
Sponsor: 09.11 Clean Space, 09.06 Healthcare Facilities
Chair: Roger Lautz, P.E., Member, Affiliated Engineers, Brookfield, WI

Compounding, protective environments, sterile supplies, surgery and other clean spaces require special ventilation in order to protect the patients, workers and visitors in health care facilities. This session addresses current requirements, ongoing research and case studies, and potential standards' proposals related to proper ventilation of clean spaces in healthcare facilities.

1. Worker Protection within the Healthcare Pharmacy: Engineering Recommendations from the NIOSH Alert on Hazardous Drugs

***Kenneth R. Mead, P.E.**, CDC/NIOSH/DART, Washington, DC*

Hazardous drugs, like those used for cancer therapy, have a successful history in treating patients; however, many are associated with an increase risk of cancers or adverse reproductive outcomes. For patients, the risks are acceptable given the therapeutic benefits. For 6 million US healthcare workers, these risks are unacceptable when occurring as non-therapeutic occupational exposures. This presentation will discuss the worker-protective design guidance and engineering recommendations identified in the Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH) Alert: Preventing Occupational Exposure to Antineoplastic and Other Hazardous Drugs in Health Care Settings.

2. Filtration and Particle Removal in Healthcare Cleanrooms

***R. Vijayakumar, Ph.D., Member**, AERFIL, LLC, Syracuse, NY*

Cleanliness of air in health care and pharmaceutical facilities require effective filtration systems and their proper operation in service. In practice this is achieved by proper selection of high efficiency filters and periodic testing in accordance with appropriate standards. This seminar will present the basic theory of particle mechanics and filtration underlying the best practice for filter selection and testing. Common pitfalls and misconception that may lead to compromised cleanliness will also be addressed.

3. Facility Requirements for Compounding Sterile Preparations

***James T. Wagner**, Controlled Environment Consulting, Hellertown, PA*

The U.S. Pharmacopeia's (USP) General Chapter <797> Pharmaceutical Compounding - Sterile Preparations establishes quality practice standards. This chapter became official on January 1, 2004. USP received numerous substantive comments about the chapter. Understanding the weightiness of these concerns, the USP Sterile Compounding Committee revised the chapter. These changes became effective June 1, 2008. This presentation will explain the changes to the chapter as they relate to facilities and environmental concerns. Strategies that have proven successful in the two years since the changes as well as the pitfalls that have created problems will also be discussed.

Sunday, June 27, 2010, 11:00 AM-11:40 AM

Forum 1 (Advanced)

How International Is Sustainability? What Is Being Done around the Globe? What Should Be Done?

Track: Living with HVAC&R Systems
Room: Cimarron
Sponsor: 02.08 Building Environmental Impacts and Sustainability
Chair: Francis Mills, P.E., Member, Sinclair Knight Merz, Manchester, United Kingdom

ASHRAE is leading the drive for sustainability across North America - and, through the efforts of ASHRAE international members, in many other countries, too. But how do we compare across the globe - are we true world leaders or are others doing more and better. How can ASHRAE become the true world leader in sustainability, what do we need to do next to lead the way forward and how can all ASHRAE members benefit by being involved? This forum looks at recent ASHRAE publications, Std. 189.1, the Green Guide, Handbooks, AEDGs and compares with international standards, guides, practices and future developments.

Sunday, June 27, 2010, 11:45 AM-12:30 PM

Forum 2 (Intermediate)

Can HVAC&R Sustainability and Security Co-exist?

Track: Living with HVAC&R Systems
Room: Cimarron
Sponsor: TG 2.HVACR Security
Chair: Scott D. Campbell, Ph.D., P.E., Str-Analysis, AL

Design of HVAC&R systems for sustainability is becoming the norm. However, security concerns from either deliberate or accidental releases of harmful agents also cannot be ignored. It is often stated that sustainability and security are mutually exclusive. This forum seeks to collect input on how security and sustainability can be balanced to achieve both purposes.

Sunday, June 27
1:30 P.M.-3:00 P.M.

Sunday, June 27, 2010, 1:30 PM-3:00 PM

Technical Paper Session 2 (Advanced)

Energy Efficient Retrofit Measures for Government Buildings

Track: Energy Conservation vs. New Generation
Room: Cimarron
Chair: Michael Deru, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

Energy Efficient Retrofits of existing buildings is extremely important to reduce our energy and carbon budgets. The International Energy Agency Annex 46 has been working on this issue for several years and has developed several tools for helping determine the most cost effective measures to pursue and the best mechanisms for implementing the measures.

1. The Economics of Energy Savings Performance Contracts (AB-10-004)
John Shonder, Member, *Oak Ridge National Laboratory, Oak Ridge, TN*

Abstract: In response to a series of legislative mandates and executive orders, the US federal government reduced the energy intensity of these buildings by nearly 30%, from 139,840 Btu per square foot in 1985 to 98,171 Btu per square foot in 2006 (USDOE 2008). The cost of achieving this result was approximately $7.3 billion, which represents the total investment in federal energy efficiency projects over the period. Approximately 43% of the funding came from private sector financing. Governments in other countries and municipal/state governments, universities, schools and hospitals are also leveraging private financing to help meet energy goals.

2. Screening of Energy Efficient Technologies for Industrial Buildings' Retrofits (AB-10-005)
*Alexander Zhivov, Ph.D., Member[1], Richard Liesen, Ph.D.[2], **Dan Fisher, Ph.D.**[3], Barry Wilson[3] and Jon Hand, Ph.D.[4], (1)U.S. Army Corps of Engineers, Champaign, IL, (2)Owens Corning, Champaign, IL, (3)Oklahoma State University, Stillwater, OK, (4)University of Strathclyde, Glasgow, Scotland*

During the past few years, U.S. Army Corps of Engineers' Engineer Research and Development Center (ERDC) has led energy and process optimization initiatives to help Department of Defense installations to meet energy efficiency and environmental compliance requirements and to create an improved work environment. This effort was also a part of the IEA- ECBCS International Energy Agency – Energy Conservation in Buildings and Community Systems' Annex 46, "Holistic Assessment Tool-kit on Energy Efficient Retrofit Measures for Government Buildings—EnERGo."

Sunday, June 27, 2010, 1:30 PM-3:00 PM

Technical Paper Session 3 (Advanced)

Sensors, Assessments and Measurements

Track: Energy Facts vs. Simulation
Room: Ruidoso
Chair: Julia Keen, Kansas State University, N/A

abstract

1. An Experimental Evaluation of HVAC-Grade Carbon-Dioxide Sensors: Part 4, Effects of Ageing on Sensor Performance (AB-10-006)
Som S. Shrestha, Ph.D., Member[1] *and Gregory M. Maxwell, Ph.D., Member*[2]*, (1)Oak Ridge National Laboratory, Oak Ridge, TN, (2)Iowa State University, Ames, IA*

Abstract: This is the fourth paper in a four-part series reporting on the test and evaluation of typical wall-mounted carbon-dioxide sensors used in building HVAC applications. Fifteen models of NDIR HVAC-grade wall-mounted CO2 sensors were tested and evaluated to determine the effect of ageing on the sensors' performance. In all, 45 sensors were evaluated: three from each of the 15 models. Among the 15 models tested, eight models have a single-lamp, single-wavelength configuration, four models have a dual-lamp, single-wavelength configuration, and three models have a single-lamp, dual-wavelength configuration.

2. A Methodology for the Comprehensive Evaluation of the Indoor Climate Based on Human Body Response: Evaluation of the Hygrothermal Microclimate Based on Human Psychology (AB-10-007)
Miloslav Jokl, *Czech Technical University, Prague, Czech Republic*

Abstract: Abstract A new way of the thermal level environment assessment based on "operative temperature thermal level" and new units "decitherm" are introduced, which allow the feelings of man to be followed. Simultaneously the fact that the operative temperature decrease is felt the more unpleasantly the lower are temperatures is also taken into account. The assessment in decitherms also allows the comparison (based on numerical values comparison) with the noise level in decibels and odor level in deciodors and the whole environment level assessment (based on weighted constituent levels adding).

3. Energy Measurements and Modeling of Air-Side Economizers in California (AB-10-008)
Srirupa Ganguly[1]*, Steve Greenberg*[2]*, William Tschudi*[1]*, Ashok Gadgil*[1] *and Hillary Price*[3]*, (1)University of Illinois, Urbana, IL, (2)Lawrence Berkeley National Laboratory, Berkeley, CA, (3)Rumsey Engineers, Oakland, CA*

Abstract: This paper provides an overview of empirical energy measurements of an air-side economizer based system for different HVAC filtration levels at a data center in San Jose, California. Further, it develops a model to compare energy savings for different climatic zones in California. The model also delves into understanding the effect of pressure drop from various filtration options on HVAC energy savings. In addition, the paper also considers life-cycle costing of an economizer-based system in comparison to a conventional data center.

Sunday, June 27, 2010, 1:30 PM-3:00 PM

Conference Paper Session 3 (Advanced)

Energy Efficient Operation and Design of Data Centers

Track: High Efficiency HVAC Systems
Room: Mesilla
Chair: Nick Gangemi, Data Aire, Inc, Orange, CA

This session will address efficiency improvement options in Data Centers and the resultant operating cost associated with the potential improvements.

1. 08Economizers in Datacom-Risk Mission Vs. Reward Environment? (AB-10-C008)
David Quirk, P.E., Member[1] *and Vali Sorell, Member*[2]*, (1)Verizon Wireless, Basking Ridge, New Jersey, (2)Syska Hennessy, Charlotte, NC*

This discussion attempts to arm the reader with an increased understanding of several aspects of the application of both airside and waterside economizers to datacom facilities so that the right decisions and considerations can be made to serve BOTH mission and energy.

2. Total Cost of Ownership Comparison of Air Economizers vs. Other Energy Saving Techniques in Data Center Applications (AB-10-C009)
Ron Spangler, Member[1] *and Greg Jeffers, P.E., Member*[2]*, (1)Emerson, McKenney, TX, (2)McKenneys, Inc, Atlanta, GA*

This paper will include a case-study, showing equipment and installation costs of an air economizer system, and non air economizer systems, along with the energy consumption of each. In addition to energy savings, total cost of ownership must also be considered when deciding on a employing more energy efficient solutions. Equipment and installation costs, along with annual energy costs will be used to calculate and compare total cost of ownership over a 15 year period.

3. Cooling Efficiency in Contained Applications Using Intelligent Controls (AB-10-C010)
Dave Kelley, Member, *Emerson Network Power-Liebert, Columbus, OH*

This paper will go beyond these basic requirements to look at the effect of using aisle containment in conjunction with the necessary monitoring and control of the cooling system to provide a more efficient cooling system. This is accomplished by controlling both the supply air temperature and airflow to align the cooling system with the rack temperature and airflow requirements. Comparisons between several scenarios will be made.

Sunday, June 27, 2010, 1:30 PM-3:00 PM

Seminar 13 (Intermediate)

Energy Efficiency Opportunities in Laboratories: Exhaust Systems, Controls Techniques and Energy Recovery Options

Track: High Efficiency HVAC Systems
Room: Aztec
Sponsor: 09.10 Laboratory Systems
Chair: Wade Conlan, P.E., X-nth, Maitland, FL

Labs present great opportunities to reduce energy consumption of systems used in most designs today. Utilizing proper design of exhaust systems, incorporating control techniques for space and system management, and a fresh look at energy recovery provides an all encompassing approach to create a high efficiency lab.

1. Reducing Energy and Maintaining Safety in Lab Exhaust Systems
Anthony Rossi, Member*, Greenheck Fan Corp., Indianapolis, IN*

There is much discussion and design focus today at reducing energy in laboratory systems using 100% make-up air. Some energy saving schemes ignore "time proven" safe laboratory practices, all at the "expense" of saving energy. This presentation will discuss design application aspects, as well as considerations for maintaining ventilation safety and practical energy savings in laboratory exhaust systems.

2. Profiling Laboratory Environments with the BMS to Optimize Lifecycle Performance
Hideya Saito, Member*, Yamatake Corp., Tokyo, Japan*

A properly designed and operated laboratory VAV system offers substantial energy savings and payback. It has yet to gain popularity in Japan because of its higher first cost, complexity and lack of end-user education to maximize its performance. This seminar examines how performance profiling of fume hood usage helps in optimizing laboratory HVAC systems thru the BMS. Quantitative data that was gathered by profiling numerous VAV based fume hood systems will be utilized to show the benefits. Recommendations are provided to designers, facility managers, owners and researchers to enhance the lifetime value and efficient operation of labs.

3. Energy Recovery: An Efficient and Novel Way to Provide Frost Protection
Wayne Lawton, P.E., Life Member*, Merrick and Co., Aurora, CO*

This presentation presents a novel way to increase the efficiency and effectiveness during cold weather and allows for full energy recovery. Conventional strategies end up minimizing energy recovery effectiveness during cold weather and missing the reduction of heating plant size. Providing energy recovery using the proposed method has increased the amount of energy recovered and reduced the project first cost by reducing the size of the heating plant.

Sunday, June 27, 2010, 1:30 PM-3:00 PM

Seminar 14 (Intermediate)

I Love It When a Plan Comes Together! IPD in Theory and Practice

Track: Professional Skills
Room: San Miguel
Sponsor: 07.01 Integrated Building Design, TC 2.8 Building Environmental Impacts and Sustain, 01.07 Business, Management & General Legal Education
Chair: E. Mitchell Swann, P.E., Member, MDC Systems, Paoli, PA

Integrated Project Delivery (IPD) is buzzing through the industry often as the tag team partner of BIM and I the jet stream of “green”. IPD is both old and new, but more importantly IPD is neither a “technology platform” like BIM nor a project “objective” like green. It is an operational philosophy implemented as a project execution strategy. This seminar will touch on key areas of IPD including an overview of the philosophy and process, some case histories of projects executed and how to address some of the murky issues raised along the blurred contract lines often inherent in IPD.

1. Setting the Horizon: An Overview of IPD and the ANSI/MTS 1.0 Whole Systems Integrated Process Guide (WSIP) for Sustainable Buildings & Communities 2007
E. Mitchell Swann, P.E., Member*, MDC Systems, Paoli, PA*

Executing a project using IPD requires a different mindset and approach to the design and construction process. In order to truly realize the benefits of IPD the project execution process must be reconceptualized from a linear, ‘information hand-off' process to an interactive process where objectives, inputs and solutions are arrived at collectively and where the universe of project stakeholders is considered broader than the holder of the checkbook. This presentation will present an overview of the general IPD process and a more detailed look at the ANSI/MTS Standard's approach towards IPD in the sustainable context.

2. NREL Research Support Facility: Contractual Model for Delivery of a Large Scale Zero Energy Building
Paul Torcellini, Ph.D., Member*, National Renewable Energy Laboratory, Golden, CO*

The 220,000 sqft NREL Research Support Facility is an office building that was procured to be a zero energy building. While the net zero objective is a challenging performance target, the project was also delivered using an IPD approach which required major changes to NREL's traditional execution methods. This discussion will focus on the procurement and management process that was used to align the design-build team to deliver a project using established energy goals set by the owner.

3. Integrated Execution of a Naturally Ventilated Green Building
Thomas Marseille, P.E., Member*, WSP Flack & Kurtz, Seattle, WA*

In the process of addressing concerns from multiple stakeholders there may sometimes be incongruities between various desires or objective. The goal of a highly functioning team is to balance the various desires against the overall project objectives and the resources available. This presentation will walk thru the design and operations process needed to achieve the building owner's objectives (the Owner is an architect) and the needs of the tenants (the Architect is also a tenant!).

4. Resolving Disputes in an IPD World
Peter Merrill, J.D.*, Construction Dispute Resolution Services, LLC, Santa Fe, NM*

While IPD is intended to eliminate the threat of disputes on a project, the reality is that project involves people and people are going to have miscommunication, misunderstandings and disputes. The contractual format used in IPD can make it difficult to strike clear lines in the sand regarding responsibilities and liabilities for various aspects of a project. This presentation will help to identify how some of those lines can be drawn or redrawn and some techniques for dealing with disputes should they arise.

Sunday, June 27, 2010, 1:30 PM-3:00 PM

Seminar 15 (Intermediate)

Is Building Ventilation an Effective Public Health Measure?

Track: Ventilation Systems
Room: Brazos
Sponsor: Environmental Health Committee
Chair: Hal Levin, Fellow ASHRAE, Building Ecology Research Group, Santa Cruz, CA

ASHRAE's approach to controlling indoor air quality including but not limited to both airborne infectious agents and other potential health threats is primarily through the use of ventilation. The question that will be discussed in this seminar is the relationship of ventilation to health and whether ventilation

design, operation or performance actually impact the health of building occupants. Related to infectious agents including but not limited to H1N1, swine flu, and other infectious diseases, the seminar presenters will discuss the factors relevant to engineers.

1. Health and Engineering: What Clinicians and Engineers Can Learn From Each Other
***Michael J. Hodgson, M.D.**, Veterans Administration, Washington, DC*

The Veterans Health Administration is a integrated health care delivery system with 124 surgery programs in some of the US' oldest hospitals. Because it is a single system, worst and best things pop up to national attention. This presentation will describe unusual adverse events and lessons from attempts at system evaluation.

2. Designing Sustainable Ventilation Systems for Healthcare Settings in Resource-Limited Countries
***Paul A. Jensen, Ph.D., P.E.**, U.S. Public Health Service, Atlanta, GA*

Based on vast experience advising designers and operators of health care facilities around the world, this presentation will distill lessons learned with an emphasis on resource-poor contexts. Both advantages and disadvantages of natural and mechanical ventilation will be discussed with a special focus on the relevance to prevention of airborne disease transmission.

3. Evidence for Airborne Transmission and Impact of Building Ventilation Rates on Infection Spread in an Urban Community
***Yuguo Li, Fellow ASHRAE**, Hong Kong University, Hong Kong, China*

Indoor environments—offices, homes, hospital wards, classrooms, restaurants and public transport—are "connected" in terms of airborne disease transmission between people. People are constantly in contact as they move from one indoor environment to another, making it very easy for an airborne disease to be transmitted from an infected to a susceptible individual and ultimately to others. Good building ventilation might be an effective way of controlling some infections, but little is known about its effectiveness.

Sunday, June 27, 2010, 1:30 PM-3:00 PM

Seminar 16 (Intermediate)

Variable Speed Comparison: Induction vs. Permanent Magnet Motors

Track: High Efficiency HVAC Systems
Room: Dona Ana
Sponsor: 01.11 Electric Motors and Motor Control
Chair: Armin Hauer, Ebm-Papst, Farmington, CT

Increased HVAC&R system efficiency is necessary for energy conservation. A key factor in meeting this consumer and regulatory demand is variable speed technology applied to the system prime movers: compressors, blowers, fans and pumps. The induction motor has been the workhorse for our industry for many years but the permanent magnet motor seems to gain importance. Which motor technology is the best? This program explores some real world comparisons that may help answer that question.

1. Can a Variable Speed Induction Motor Be Better than a Permanent Magnet Motor?
***Robert W. Helt, Member**, Helt Engineering, Portland, ME*

The general thought today is that a variable speed permanent magnet motor is better than a variable speed induction motor. The permanent magnet motor can be made to operate more efficiently than the variable speed induction motor. Several application issues with the permanent magnet motor could make the induction motor a better candidate. A case study of an application will be discussed where the induction motor was actually a better application. Examples include a motor in high volume products today. A comparison of the potential issue for each type of motor will be discussed.

2. Cooling Tower Case Study: Induction vs. PM Synchronous Motor Technology
***Richard R. Schaefer**, Baldor Electric Co., Greenville, SC*

Test results of twin cooling towers, one running with a traditional gearbox and an induction motor and its companion tower equipped with a direct drive PM synchronous motor will be examined. The attributes of PM technology in addition to efficiency gains when using variable speed control to achieve optimum chilled water temperature will be highlighted. This case study was conducted in a carefully controlled, real world environment on the campus of Clemson University with test results certified by an independent third party. Advantages and disadvantages of fixed speed and variable speed both induction and PM synchronous motors will be discussed.

3. Decisive Differences of Speed-Controlled Induction Motors and EC Motors
***Armin Hauer**, Ebm-Papst, Farmington, CT*

Discover the built-in motor features that help with a true first-cost comparison. How do common utility incentive programs recognize both motor systems today? How is motor overload protection accomplished? How does the motor speed control method affect the sound, the efficiency, and the equipment design?

Sunday, June 27, 2010, 1:30 PM-3:30 PM

Seminar 17 (Basic)

Water Treatment Considerations for Net Zero Buildings: Operational Realities

Track: Living with HVAC&R Systems
Room: Galisteo
Sponsor: 03.06 Water Treatment, TC 8.6 Cooling Towers and Evaporative Condensers
Chair: Scott Mayes, Member , Scott's Square Deal, Olathe, KS

Cooling towers are the largest water using utility in buildings. Water treatment of cooling towers can have a dramatic effect on the energy used in a building, and the ease of operation and life of cooling water equipment. Deteriorating water quality and decreasing sources of potable water are driving new initiatives in water conservation. Water treatment strategies that reduce potable water use and preserve resources have been successfully implemented in the past decade. The strategies presented will cover basic operational methods, treatment strategies and approaches for potable water reduction and the goal of designing net zero buildings that are still functional and operate as designed. In addition, the results of recent ASHRAE-funded research are presented.

1. Water Treatment Fundamentals
***Mike Adams, Member**, Garrett Calahan, Atlanta, GA*

This session will cover methods to minimize water and energy usage with changes in the water treatment programs, design changes and pretreatment systems.

2. Water Reduction Strategies for Cooling Towers
***Jon Cohen, Member**, HOH Water Technology, Inc., Chicago, IL*

Cooling towers are the largest water using utility in buildings. Deteriorating water quality and decreasing sources of potable water are driving new initiatives in water conservation. Water treatment strategies that reduce potable water use and preserve resources have been successfully implemented in the past decade. The

strategies presented will cover basic operational methods, treatment strategies and approaches for potable water reduction. An overview of key strategies and design criteria for architects and engineers will assist in the implementation of efficient potable water use in condenser water systems.

3. Energy Savings through Filtration
***Allyn Troisi, Member**, LAKOS, Fresno, CA*

This session looks at how filtration can be applied in a system to help increase energy savings, water savings, and related maintenance costs. It will also cover some basic filtration principles and best practices, as well as what to consider when selecting the best filtration method for your application.

4. Results of ASHRAE 1361-RP, Biological Control in Cooling Water Systems using Non-Chemical Water Treatment Devices
***Radisav Vidic, Ph.D., P.E.**, University of Pittsburgh, Pittsburgh, PA*

The specific objective was to evaluate several classes of non-chemical treatment devices (NCDs using magnetic field, pulsed and static electric field, ultrasound, and a hydrodynamic cavitation) for controlling biological activity in a model cooling tower system. Two model towers were operated side by side using the operating parameters that simulated field conditions (one tower served as the untreated control while the NCD was installed on the second tower). The results of this study in terms of the ability of each device to control planktonic and sessile microbial growth under the experimental conditions used in this study are presented.

5. Performance Metrics of Green Water Treatments
***Michael P. Patton, Member**, Dolphin WaterCare Divsion, Clearwater Systems Corp., Essex, CT*

How do you know your "green" water treatment program is working? Or not? This session will deal with available and emerging performance criteria to judge success…. or failure. We'll review how to quantitatively understand how deposition, corrosion, bio accumulation, and cleanliness measurement tools can be used to judge the success … or failure….. of your green water treatment program.

Sunday, June 27
3:00 P.M.-4:00 P.M.

Sunday, June 27, 2010, 3:00 PM-4:00 PM

Workshop 1 (Basic) Free Session – No Badge Required

Maximizing Your Charitable Efficiency

Room: Aztec
Sponsor: ASHRAE Foundation
Chair: Bert Huffman, ASHRAE Foundation, Atlanta, GA

Is the idea of planning your estate a bit overwhelming? This session breaks down the basics, and tells you what everyone should know about the latest estate planning options available today. Jeff Lydenberg discusses how you can ensure the future of your family and even that of ASHRAE for generations to come. He is an engaging speaker who will describe how every member can participate in supporting the ASHRAE mission in a way and at a level that suits their needs. Do you know there are ways of charitable giving that can preserve maximum flexibility, increase current cash flow, reduce or avoid taxes and even maximize wealth transfer to heirs? Regardless of your means, there is probably a way for you to leave a legacy.

1. Maximizing Your Charitable Efficiency
***Jeff Lydenberg**, PG Calc, Cambridge, MA*

This session addresses how you can ensure the future of your family, and even that of ASHRAE for generations to come. Jeff is an engaging speaker who will describe how every member can participate in supporting the ASHRAE mission in a way and at a level that suits their needs. Do you know there are ways of charitable giving that can preserve maximum flexibility, increase current cash flow, reduce or avoid taxes and even maximize wealth transfer to heirs? Regardless of your means, there is probably a way for you to leave a legacy.

Monday, June 28
8:00 A.M.-9:30 A.M.

Monday, June 28, 2010, 8:00 AM-9:30 AM

Conference Paper Session 4 (Advanced)

Raising Efficiency from Buildings to Green Cities: Exergy Aspects

Track: Energy Conservation vs. New Generation
Room: Cimarron
Sponsor: TG1 Exergy Analysis for Sustainable Buildings
Chair: Kimberly Barker, Siemens Industry, Inc. Buffalo Grove, IL

This session addresses the exergy aspects and roadmaps for raising the efficiency of the built environment in macro-scale, up to district and city level. It also addresses raising the level of exergy rationality, i.e. the level of match in the supply and demand exergy to reduce carbon emissions.

1. Exergy Aspects of Operative Temperature and Its Implications on Sustainable Building Performance (AB-10-C011)
***Birol Kilkis, Ph.D., Member**, Baskent University, Ankara, Turkey*

This study investigates the fundamental relationship among thermal comfort, energy use, and exergy efficiency in a high performance building in a hot and humid climate and describes a new optimization algorithm for the right balance.

2. A Dynamic Operative Temperature Sensor for Low-Exergy High Performance Buildings (AB-10-C012)
***Birol Kilkis, Ph.D., Member**, Baskent University, Ankara, Turkey*

Existing operative temperature sensors are either impractically sophisticated, expensive, and designed for laboratories, or inaccurate for everyday life. In this study a new, practical and real-time responsive operative temperature sensor algorithm and prototype was designed, which may be easily calibrated in the ANSI/ASHRAE Standard 138 Test Chamber for all variables involved, and then precisely and dynamically corrected in the field with the same algorithm. This paper explains the basics of new sensing and correction algorithm and presents the details of the prototype. A discussion follows about its impact on low-exergy building operation, energy savings, economy, and environmental footprint.

3. An Optimum Decision-Making Algorithm for Energy Efficient Cooling in Green Cities-From Split Systems to District Cooling (AB-10-C013)
***Siir Kilkis, Student Member**, KTH, Stockholm, Sweden*

One of the dilemmas of this decade seems to be the fact that the need for comfort and high-density cooling increases with global warming while global warming further increases with its resultant CO_2 emissions. This dilemma can only be solved by achieving cooling systems with smaller CO_2 footprints. This effort involves multiple fronts, namely, new, sustainable, and low-exergy cooling systems, highly efficient cooling energy supplies, novel distribution networks, and innovative energy conversion systems. All of these solutions must, however, meet at a common denominator for decision-making.

Monday, June 28, 2010, 8:00 AM-9:30 AM

Seminar 18 (Basic)

Developing High Performance HVAC Systems using Optimization Techniques

Track: High Efficiency HVAC Systems
Room: Galisteo
Sponsor: TG1 Optimization
Chair: Stephen Treado, Member, Pennsylvania State University, State College, PA

This session addresses how optimization techniques can be effectively used to improve the energy efficiency and thermal performance of building space conditioning systems. A wide range of potential approaches are discussed, and their relative merits and appropriate applications compared.

1. Approximation Assisted Optimization from Fundamentals to Next Generation Heat Exchanger Design
***Vikrant Aute, Member**, University of Maryland, College Park, MD*

The growing need for more efficient HVAC&R system components can be realized through systematic optimization. This presentation describes a method to reduce the computational cost associated with optimization studies using approximation techniques. Furthermore, an example of novel heat exchanger design optimization is presented using a newly developed adaptive approximation assisted optimization technique.

2. Fundamentals of Optimization, and How to Apply Them to Solve Engineering Problems
***Michael Wetter, Ph.D., Member**, Lawrence Berkeley National Laboratory, Berkeley, CA*

This presentation introduces fundamentals of optimization to explain what problems can be addressed by optimization and how an engineering problem can be formulated as an optimization problem. Next, a collection of examples will be presented where optimization was used to solve engineering problems.

3. Engineering Optimization: From Intuition to Systematic Techniques
***Omar Abdelaziz, Ph.D., Member**, Oak Ridge National Laboratory, Oak Ridge, TN*

Engineers used to intuitively search for "optimum" solutions using intuition and parametric analysis. This method relied mainly on the experience level and can only be applied when a limited number of design variables and alternative solutions are present. Recently, systems are getting more and more complex and more alternatives are being introduced for the same problem. These optimization problems can be efficiently handled using systematic techniques; especially when multiple conflicting objectives are present. Real engineering optimization problem related to the HVAC&R industry will be used to describe the limitation of intuition and previously used methods.

Monday, June 28, 2010, 8:00 AM-9:30 AM

Seminar 19 (Intermediate)

Displacement Ventilation for Patient Rooms

Track: Ventilation Systems
Room: Aztec
Sponsor: 05.03 Room Air Distribution, 04.10 Indoor Environmental Modeling
Chair: Arash Guity, P.E., Member, M+NLB, San Francisco, CA

Displacement ventilation has been applied to patient rooms. Does the ventilation provide a better indoor air quality? This seminar is designed to answer said question by assembling a team of experts from academia and design practitioners. The results show that displacement ventilation can provide a better air quality than conventional mixing systems if it is carefully designed.

1. Numerical and Empirical Analyses of Ventilation Systems for Patient Rooms
***Weiran Xu, Ph.D.**[1] and Qingyan Chen, Ph.D., Member[2], (1)Mentor Graphics, Malboro, MA, (2)Purdue University, West Lafayette, IN*

Numerical and empirical analysis of a displacement ventilation system as compared with a conventional overhead mixing system in a patient room.

2. Design Considerations for Room Air Distribution in Patient Rooms
***Bob Gulick, Member**, M+NLB, San Francisco, CA*

Discussion on design considerations for room air distribution systems in hospital patient rooms.

3. Design Considerations for Ventilation Systems in Patient Rooms
***Paul Marmion**, Stantec, Vancouver, BC, Canada*

Discussion on design considerations for ventilation systems for hospital patient rooms.

4. Comparative Study on Displacement and Mixing Ventilation in a Patient Ward
***Qingyan Chen, Ph.D., Member**, Purdue University, West Lafayette, IN*

In hospital patient wards, exhalation flow from a patient with airborne infectious diseases can impose health risks to caretakers and visitors. Usually, mixing ventilation has been used to remove the airborne contaminants, but now displacement ventilation is becoming popular in such wards. This study investigated experimentally the performance of both mixing and displacement ventilation by using a full-scale environmental chamber to simulate a one-person patient ward. Our results show that displacement ventilation may or may not provide a better air quality in the ward, depending on the location of the exhaust in relation to the restroom.

Monday, June 28, 2010, 8:00 AM-9:30 AM

Seminar 20 (Intermediate)

Linking Fundamentals of Ventilation and Air Infiltration to Practice

Track: Ventilation Systems
Room: Brazos
Sponsor: TC 4.3 Ventilation Requirements and Infiltration
Chair: Anil Parekh, P.Eng., Member, Natural Resources Canada, Ottawa, ON, Canada

TC 4.3 is initiating 'Back to Basics' series of seminars to educate young engineers, HVAC professionals and trades about the fundamental aspects of ventilation, air infiltration and their interactions. This seminar explains definitions, terminologies, driving forces due to indoor and outdoor pressure regimes, and interactive effects of air infiltration and ventilation aspects. Using these principles, case examples of ventilation systems applicable to residential commercial buildings are presented. Attendees will obtain a qualitative fundamental understanding of infiltration and ventilation aspects and will be able to employ sound assessment of different ventilation strategies for residential and commercial buildings.

1. The V in ASHRAE: Air Flows through Buildings Matter!

***Brian Rock, Ph.D., P.E., Fellow ASHRAE**, The University of Kansas, Lawrence, KS*

In our quest to create more sustainable buildings we must remember our basic professional obligation to help protect the health and safety of the public. Making buildings too “tight” can yield indoor air quality problems, yet too “loose” and our buildings become unpleasant and also resource hogs. Balancing operating expenses, initial costs, air quality, thermal comfort, owner preferences, and code requirements is an increasingly difficult challenge for HVAC practitioners. In this seminar the fundamental concepts of, and terminology and goals for building air exchange, via ventilation, infiltration, and exhaust will be introduced for both residential and non-residential applications.

2. Infiltration Driving Forces: Wind Pressure and Stack Effect

***John Carter, Member**, CPP, Inc., Fort Collins, CO*

Natural ventilation and infiltration are driven by pressure differences across the building envelope caused by wind pressure and temperature differences between indoor and outdoor air (stack effect). Mechanical air-moving systems also induce these pressure differences. The governing physics of wind and temperature driving mechanisms will be discussed and design techniques that can be used to quantify the effects will be outlined.

3. Simplified Ventilation and Infiltration Calculations

***Iain Walker, Ph.D., Member**, Indoor Environment Dept., Lawrence Berkeley National Laboratory, Berkeley, CA*

Simplified methods have been developed for estimating ventilation in buildings. Primarily used in low-rise residential applications the principles behind the models also apply to larger buildings. As residential construction and energy codes lead to requirements for tighter envelopes and require mechanical ventilation, we can use some simple tools to understand how ventilation works in residences and to perform simple design calculations. Simplified models for natural infiltration from the Handbook of Fundamentals will be presented and discussed. Example will be used to illustrate the principles behind these interacting airflows and to show how compliance with Standard ASHRAE 62.2 can be achieved.

Monday, June 28, 2010, 8:00 AM-9:30 AM

Seminar 21 (Intermediate)

Odd Moisture Management Issues in Dry Climates

Track: Living with HVAC&R Systems

Room: Mesilla

Sponsor: 01.12 Moisture Management in Buildings

Chair: Neil P. Leslie, P.E., Member, Gas Technology Institute, Des Plaines, IL

Dry climates pose unusual moisture management problems for building systems and occupants, including health issues requiring proper humidification to address, and building durability and health issues requiring proper dehumidification to address. Moisture issues can be created by HVAC systems, insulation location, and interactions between the systems and building materials. By adding moisture to the air, HVAC systems can also create some unique condensation concerns. Case studies of problems and solutions identified for dry climates are provided, with special focus on roof systems, evaporative cooling challenges and options, and occupant health effects associated with dry air.

1. White Roofs, Wet Roofs

***William B. Rose, Member**, University of Illinois Building Research Council, Champaign, IL*

Clear skies are common in low-humidity climates. Clear skies permit infrared losses from buildings to the sky. If the roof surface has a high solar reflectance and a high emittance, the net result may be heat loss from the roof system leading to low roof temperatures. Low temperatures may lead to moisture problems. One instance of high humidity in white roof systems is presented here.

2. Evaporative Coolers: A Swamp in the Desert?

***Holly Bailey, P.E., Associate Member**, Bailey Engineering Corp., Jupiter, FL*

‘Swamp Coolers' (evaporative coolers) have long been known for their economical and effective cooling capabilities in some climates. Although the name implies they cool swamps – the reality is they can create ‘swamps' inside a building in some situations. Through some case studies, this presentation will look at moisture issues that can occur in buildings with the use of ‘swamp coolers' even in dry outside climates.

3. Low Humidity Effects on Building Occupants

***Andreas Holm**, Fraunhofer-Institut Bauphysik, Germany*

ASHRAE Standard 55 has removed the lower relative humidity limit from the current standard, noting that very dry air is not important from a thermal comfort perspective. However, significant health issues may be associated with “comfortable” dry air. This presentation will describe some of the possible effects of low humidity on building occupants. It will also discuss useful humidity management strategies in dry climates.

Monday, June 28, 2010, 8:00 AM-9:30 AM

Seminar 22 (Basic)

Residential Water Heaters: A New Test Method?

Track: Energy Facts vs. Simulation

Room: Dona Ana

Sponsor: 06.06 Service Water Heating

Chair: Ben Schoenbauer, Associate Member, Center for Energy and Environment, Minneapolis, MN

Water heating is one of the largest yet least efficient end uses of energy in homes, and thus offers significant potential for energy savings. Capturing these savings requires accurate methods of test to guide product development, federal efficiency standards and purchaser decisions. Both ASHRAE and the U.S. Department of Energy have begun to reevaluate current testing and rating procedures. This session presents the results of field and laboratory work aimed at more accurately estimating residential hot water use and usage patterns and predicting associated energy use. Speakers discuss their test methods and compare them to current ASHRAE and federal test procedures.

1. Overview of Residential Water Heater Test Procedure and Challenges

***James Lutz, Member**, Lawrence Berkeley National Laboratory, Berkeley, CA*

The current test procedure for residential water heaters is a 24 hour simulated use test. The efficiency reported is the ratio of the output (as heat in water) to the energy input. There are several issues with the current test procedure that need to be addressed. Size limitations in the procedure exclude many water heaters that are being used in residential applications. The draw pattern of 6 equal long draws and 18 hours of stand-by does not accurately represent hot water usage in homes. The same daily volume is applied to all heaters regardless of size or intended application.

2. Field and Laboratory Data Showing the Challenges of Testing Water Heaters

***Martin Thomas, Member**, CANMET Energy Technology Centre, Ottawa, ON, Canada*

Field studies throughout Ontario have been conducted to learn about hot water use with a view to revising the current residential water heater test methodology. Volume, rate, duration and idle time between draws vary every day and in every home. These factors are important in determining the performance of a water heater. This talk highlights the difficulties in developing a standard that fairly represents the performance of all water heaters under real world conditions. Preliminary results have been used to design laboratory tests with several draw profiles to determine the effect on the Energy Factor of different water heating technologies.

3. Measurement and Application of Performance Curves for Residential Water Heaters

***Thomas Butcher, Ph.D., Member**, Brookhaven National Laboratory, Upton, NY*

This presentation reports on a lab test program which has been done on 10 different water heaters over a wide range of temperature and draw conditions. Tests include the Energy Factor and draws considered to be more representative of actual field conditions. A total of 30 different draw patterns were tested with a wide variety of flow rates, volumes and idle times. From these test results simple curves of energy input and output can be drawn. These curves can be used to predict average daily energy use providing a tool to evaluate the impact of different draw patterns on performance.

4. Modified Simulated Use with Input/Output Method
***Paul Glanville, Associate Member**, Gas Technology Institute, Des Plaines, IL*

By design the Input/Output Method of Test, allows for a water heater rating independent of hot water draw profile. This is advantageous, because it eliminates arguments about what a realistic profile would look like. Through simple laboratory tests the Input/Output method can estimate the energy input required for any draw pattern. Comparisons between estimated consumption and actual consumption of various 24 hour draw profiles were tested. Results from gas fired storage, tankless, and hybrid water heaters are examined, which highlight the challenge of equitably measuring the range of products available with a simple Method of Test.

Monday, June 28, 2010, 8:00 AM-9:30 AM

Seminar 23 (Intermediate)

Retrofitting HVAC in Older Buildings for Higher Efficiency

Track: High Efficiency HVAC Systems
Room: San Miguel
Sponsor: 09.01 Large Building Air-Conditioning Systems
Chair: Jeff J. Traylor, Member, EMCOR Government Services, Arlington, VA

This seminar shows three case studies of retrofits of three different types of existing facilities for the purpose of reducing utility costs and saving energy.

1. The Restoration of Occupied HVAC System for 100k sq. ft. Hospital Office Building while Continuously Occupied, 30% Energy Savings
***John Kuempel, Member,** DeBra-Kuempel, Cincinnati, OH*

A review of the process used to renovate a hospital "business occupancy" while in use to update the HVAC system and reduce utility expenses.

2. Energy Efficiency Retrofit of Two Historic Buildings in St. Louis
***Stephen Duda, P.E.**, Ross & Baruzzini, Inc., St. Louis, MO*

This presentation offers two case studies. The first involves VFD and economy-cycle renovations at a major art museum dating from the 1904 St. Louis World's Fair. The second involves a full-building HVAC retrofit of a circa-1920s courthouse.

3. Turning an Office Building Into a Modern Laboratory
***Kelley Cramm, P.E., Member**, Henderson Engineers, Lenexa, KS*

This project renovated several office areas of a 1950's vintage building into state of the art research laboratories. The project will be LEED certified. The presentation will discuss challenges, solutions, and lessons learned.

Monday, June 28, 2010, 8:00 AM-9:30 AM

Seminar 24 (Intermediate)

Thermal and Air Resistance Performance of Building Enclosure Systems

Track: Energy Facts vs. Simulation
Room: Ruidoso
Sponsor: 04.04 Building Materials and Building Envelope Performance
Chair: Marcus Bianchi, Ph.D., Associate Member, National Renewable Energy Laboratory, Golden, CO

This seminar discusses the effect of thermal bypasses, gaps, and installation practices on the thermal and airflow performance of building elements such as walls and attics.

1. The Effect of Insulation Installation Quality on Building Thermal Performance
***Diana Fisler, Ph.D., Associate Member**, Doug Fast, P.E. and John Brooks Smith, P.E., Associate Member, Johns Manville, Littleton, CO*

Getting the best thermal insulation performance of a wall or attic depends on proper installation of insulation materials. But how much do small gaps in and around insulation really affect performance? The differences between inset stapling vs face stapling and back gaps on kraft-faced wall insulation are shown to have a negligible affect on systems R-value. The effect of large gaps in attic insulation up to 5% are shown to be similar for several types of insulation materials.

2. Heat Flow through Air Permeable Insulation
***Doug Fast, P.E.**, Tom Fellinger and John Brooks Smith, P.E., Associate Member, Johns Manville, Littleton, CO*

Energy use in a building and comfort of the occupants depends on both heat loss through insulation and air flow through insulation. This presentation discusses the air flow resistance of various types of air permeable insulation and explores heat flow through wall assemblies with various insulation and air sealing measures. Research using ASTM C522 showed fine, glass fiber insulation provides a greater resistance to air flow than cellulose insulation.

3. Thermal Bridging through Building Enclosures: Evaluating Local and Building-Wide Impacts
***Sean O'Brien, P.E., Member**, Simpson Gumpertz & Heger, Inc., New York, NY*

Regulating heat flow is typically accomplished using thermal insulation, thermally broken fenestration products, and multi-pane insulating glass units (IGUs). However, these components are often used in conjunction with materials with significantly less resistance to heat flow – steel studs, etc. This presentation discusses the physical phenomenon of thermal bridging and examines common details and construction practices that can contribute to excessive heat loss in buildings. Quantitative examples are used to demonstrate the reductions in thermal performance that can occur in building component, maximizing the effectiveness of wall and roof insulation, and evaluating thermal bridging effects on a whole-building scale.

Monday, June 28
9:45 A.M.-10:45 A.M.

Monday, June 28, 2010, 9:45 AM-10:45 AM

Technical Paper Session 4 (Advanced)

Modeling of Wall Diffusion and Humidity Control

Track: Living with HVAC&R Systems
Room: Ruidoso
Chair: Bill Dietrich, Member, Baltimore Aircoil, Baltimore, MD

1. Field Test and Modeling Study of Walls Exposed to South Carolina Conditions (AB-10-009)
Achilles Karagiozis, Ph.D., Member[1], *Dominique Derome, Member*[2] *and Jan Carmeliet*[2], *(1)Oak Ridge National Laboratory, Oak Ridge, TN, (2)EMPA, Dubendorf, Switzerland*

A project looked at the nature, significance and control of solar-driven vapor diffusion in wall systems. The project combined experimental and simulation work to provide an in-depth characterization of the phenomena occurring during inwards vapor diffusion in insulated wall assemblies. This paper presents the modeling of the results of a field study that was performed over a period of 2 years and where possible occurrence of solar driven diffusion was documented for different wall assemblies. The specifics of the modeling such walls under climatic conditions are presented and discussed.

2. Tight Humidity Control for Flexible Applications (AB-10-010)
Peter Simmonds, Ph.D., P.E., Fellow ASHRAE[1], *Patrick Wilkinson*[1], *John Gautrey*[1] *and Jacques de Pastre*[2], *(1)IBE Consulting Engineers, Sherman Oaks, CA, (2)IBE Consulting Engineers, Paris, France*

Abstract: Humidity control of spaces is a traditional HVAC engineering process; however we tend to look at these processes in a steady state environment. When dynamics are introduced into the equation the response and performance of a conditioning system become critical. This paper will address the conditioning concepts for a newly designed museum that contains traditional galleries and non traditional spaces all designed to provide different levels of flexibility, yet at the same time provide a system that performs in response to the performance required.

Monday, June 28, 2010, 9:45 AM-10:45 AM

Conference Paper Session 5 (Advanced)

Energy Efficiency through Building Controls

Track: High Efficiency HVAC Systems
Room: Galisteo
Chair: William Healy, Ph.D., Member, National Institute of Standards and Technology, Gaithersburg, MD

1. An Agent-Based Methodology for Optimizing Building HVAC System Performance (AB-10-C014)
Stephen Treado, Member*, Pennsylvania State University, State College, PA*

This paper describes the results of a preliminary investigation regarding an agent-based methodology for optimizing building HVAC system performance. A typical commercial building HVAC was modeled, and its operation was simulated using standard models and a commercially available programming environment. The effect of varying chilled water and supply air temperatures on total system power requirements for a variable-air-volume (VAV) cooling system with a single chiller, and associated pumps and fans was determined. Application of the method to real systems is discussed, along with the need for future refinements and extensions.

2. Evolutionary Computation Approach to Heat Exchanger Optimization (AB-10-C015)
David Yashar, Ph.D., P.E.[1], *Piotr Domanski*[1], *Janusz Wojtusiak, Ph.D.*[2] *and Kenneth Kaufman, Ph.D.*[3], *(1)The National Institute of Standards and Technology, Gaithersburg, MD, (2)George Mason University, Fairfax, VA, (3)Internal Revenue Service, Washington, DC*

The efficiency of a vapor compression system is strongly influenced by the performance of the finned-tube heat exchangers it employs. Heat exchanger performance is strongly influenced by the refrigerant circuitry. This paper describes an evolutionary computation-based approach to designing an optimized refrigerant circuitry used in Intelligent System for Heat Exchanger Design (ISHED). The technique used in ISHED employs two separate approaches to generate designs. The optimization example presented in this paper employed each module independently and used the combined approach to demonstrate the benefits of each module and the power of the combined module approach.

Monday, June 28, 2010, 9:45 AM-10:45 AM

Conference Paper Session 6 (Advanced)

Equipment and Ventilation

Track: Ventilation Systems
Room: Dona Ana
Chair: Lawrence Schoen, Schoen Engineering Inc., Columbia, MD

This session focuses on dedicated outdoor air systems (DOAS). Two topics are addressed: the interaction of a DOAS unit with a building pressurization unit, and design considerations for DOAS units when applying different methods of energy recovery and the performance relative to the climate in which the system is applied.

1. DOAS and Building Pressurization (AB-10-C016)
Stanley Mumma, Ph.D., P.E., Fellow ASHRAE*, Penn State University, University Park, PA*

The central thrust of this paper is to introduce the concept of a balanced flow Dedicated outdoor air system (DOAS) integrated, physically and functionally, with a pressurization unit. The incentives for this concept include: improved total energy recovery (TER) thermal efficiency, lower first cost, no increase in the installation cost, reduced fan parasitic energy use, predictable building pressurization performance, and a very modest additional first cost for reserve capacity. This may be the next step in the migration path toward improved performance, at reduced first cost, for DOASs.

2. Energy Recovery in Air Handling Systems in Non-Residential Buildings – Design Considerations (AB-10-C017)
Caroline Markusson, Student Member[1], *Per Fahlen*[1] *and Lennart Jagemar, Member*[2], *(1)University of Technology in Gothenburg, Sweden, Gothenburg, Sweden, (2)CIT Energy Management, Gothenburg, Sweden*

Measurements from a run-around loop system with direct flow control are used as a base for a model. The influence of temperature levels, liquid and air flow rates on the temperature efficiency of the system is analyzed. Optimization of the liquid flow for obtaining the highest possible temperature efficiency at different operations in the run-around loop system is shown.

3. Performance Analysis of a Ventilation Air Heat Pump (AB-10-C018)
John Bryant, Ph.D., P.E., Membe[1] *and Dennis O'Neal, Fellow ASHRAE, Texas A&M University, College Station, TX*

This paper presents the results of an evaluation of an air-to-air heat pump design that could be used to pre-condition ventilation air. The performance evaluation for the proposed design was limited to the heating mode only. A ventilation air heat pump in the heating mode was simulated using a public domain heat pump simulation program. Design criteria for the proposed heat pump system are presented and include the primary components as well as application specific recommendations. Suggestions for improvement of the concept and barriers to commercial implementation are discussed.

Monday, June 28, 2010, 9:45 AM-10:45 AM

Conference Paper Session 7 (Advanced)

Series or Parallel? Energy Use Comparison and Performance Evaluation of VAV Fan Powered Terminal Units

Track: Energy Facts vs. Simulation
Room: Aztec
Chair: Bing Liu, P.E., Member, Pacific Northwest National Laboratory, Richland, WA

This session presents papers that detail energy consumption comparison and control strategies for series versus parallel fan powered terminal units. Though the results are specific to shaded pole type fan powered units, the results still have implication for new and existing installations. The results presented are from research performed by Texas A&M University under ASHRAE research project RP1292 and managed by the PMS of Technical Committee 5.3.

1. Energy Use Comparison for Series Vs. Parallel Fan Powered Terminal Units in a Single Duct Variable Air Volume System (AB-10-C019)
***John Bryant, Ph.D., P.E., Member**, Michael Davis, Associate Member and Dennis L. O'Neal, Ph.D., P.E., Texas A & M University, College Station, TX*

This paper presents the results from the ASHRAE Research Project RP 1292 in terms of power consumption for series vs. parallel fan powered terminal units (FPTU). Each system type was simulated in a base configuration for Houston, Texas and six different scenarios were simulated for comparison. The primary case was expanded to cover other geographic/weather locations which confirmed this trend.

2. Performance of VAV Fan Powered Terminal Units: An Evaluation of Operational Control Strategies for Series vs. Parallel Units (AB-10-C020)
***John Bryant, Ph.D., P.E., Member**, Dennis L. O'Neal, Ph.D., P.E. and Michael Davis, Associate Member, Texas A & M University, College Station, TX*

Terminal units with different primary air inlets from three different manufacturers were evaluated under ASHRAE RP 1292. This paper presents the results from the research in terms of operational control strategies for series vs. parallel fan powered terminal units. Each system type was operated in a simulation that varied geographic location in five regions of the United States and under several different control strategies. Results show that, depending on system loads, system control, and operational settings, the VAV control strategy can have a significant impact on operations, comfort conditions, and energy consumption.

Monday, June 28, 2010, 9:45 AM-10:45 AM

Conference Paper Session 8 (Advanced)

Temperature Maintenance in Data Centers

Track: High Efficiency HVAC Systems
Room: Mesilla
Chair: Michael K. Patterson, Member, Intel, Hillsboro, OR

This session will address what is the correct temperature at which a data center should be maintained and how can the temperature be maintained during a power failure and center shutdown.

1. The Right Temperature in Datacom Environments (AB-10-C021)
***David Quirk, P.E., Member**[1] and Michael K. Patterson, Member[2], (1)Verizon Wireless, Basking Ridge, New Jersey, (2)Intel, Hillsboro, OR*

This paper looks at what the right temperature is from the context of the OEM, the Architect and Engineering (A&E) firm designing the Datacom Center, the Infrastructure equipment provider, and finally the Datacom owner's viewpoint.

2. Thermal Mass Availability for Cooling Data Centers During Power Shutdown (AB-10-C022)
***Kishor Khankari, Member**, Syska Hennessy, Ann Arbor, MI*

With the help of a heat transfer model this paper systematically analyzes the effect of various parameters and the impact of rack thermal mass on the time that air requires to reach the thermal shutoff threshold temperature.

Monday, June 28, 2010, 9:45 AM-10:45 AM

Seminar 25 (Intermediate)

Dispersion Modeling for Energy Efficiency

Track: Energy Conservation vs. New Generation
Room: San Miguel
Sponsor: 09.10 Laboratory Systems, TC 4.3 Ventilation Requirements and Infiltration
Chair: Brad Cochran, Member, CPP, Fort Collins, CO

With so much focus these days placed on energy conservation, one commonly overlooked energy "hog" is a building's exhaust system. This particularly applies to laboratory buildings where the exhaust system may account for 30% to 40% of the building's total energy usage. Two of the industries' leading experts describe how dispersion modeling is currently being employed to minimize fan energy without compromising air quality concerns associated with the toxic and/or odorous exhaust. Topics cover optimizing the placement of air intakes and exhaust stacks and employing VAV technology in concert with building automation systems.

1. Exhaust Stack Design and Energy Reduction
***Michael Ratcliff, Ph.D., P.E., Member**[1] and Glenn Schuyler, P.Eng., Fellow ASHRAE[2], (1)RWDI, Redlands, CA, (2)RWDI, Guelph, ON, Canada*

Exhaust fans use energy to emit contaminated air to the outdoors through stacks. Dispersion is needed to avoid having effluents reach nearby outside air intakes. Some of the energy consumed by the fans is used to increase exit velocity to improve exhaust dispersion, not just getting the exhaust out of the building. This adds to the energy costs, especially for exhaust-intensive buildings. If the stacks and exhaust fans can be designed so that sufficient dispersion is achieved with less energy, then energy costs can be reduced. This seminar will present several strategies for utilizing dispersion modeling to reduce energy consumption.

2. Energy Saving Strategies for Laboratory Exhaust Systems
***John Carter, Member**, CPP, Inc., Fort Collins, CO*

Using state of the art engineering techniques and controls exhaust ventilation systems can optimize energy consumption by applying VAV technology. A VAV system allows the air flow in the exhaust ventilation system to match the supply air flow requirements of the building. However, the VAV system must be designed so that it does not compromise the air quality present at nearby air intake locations or other sensitive locations. Building exhaust may be re-entrained if existing CV systems are blindly converted to VAV systems without a clear understanding of how the system will perform at the lower volume flow rates.

Monday, June 28, 2010, 9:45 AM-10:45 AM

Seminar 26 (Intermediate)

High-Performance Run Around Energy Recovery Systems

Track: High Efficiency HVAC Systems
Room: Brazos
Sponsor: 09.01 Large Building Air-Conditioning Systems
Chair: Rudolf Zaengerle, Dr.Ing., Associate Member, Konvekta USA, Medina, OH

Air-conditioning systems are among the greatest energy consumers of hospitals and laboratories. European high performance 'run around energy recovery systems' (RAERS), guaranteeing strict separation of air intake and exhaust, are operating at efficiencies of 70-80%. Combined with advanced control

software, they reduce the annual energy requirement by 75-90% and at the same time provide a large reduction in peak demand. Although its initial capital cost is higher than for conventional energy recovery systems, its pay-back period is very attractive.

1. High-Performance Run around Energy Recovery Systems
***Martin Niederer, P.E.**, Konvekta AG, St. Gallen, Switzerland*

Air-conditioning systems are among the greatest energy consumers of hospitals and laboratories. European high performance 'run around energy recovery systems' (RAERS), guaranteeing strict separation of air intake and exhaust, are operating at efficiencies of 70-80%. Combined with advanced control software, they reduce the annual energy requirement by 75-90% and at the same time provide a large reduction in peak demand. Although its initial capital cost is higher than for conventional energy recovery systems, its pay-back period is very attractive.

Monday, June 28, 2010, 9:45 AM-10:45 AM

Forum 3 (Basic)

Exergy the Search for the Holy Grail

Track: Energy Conservation vs. New Generation
Room: Cimarron
Sponsor: TG1 Exergy Analysis for Sustainable Buildings
Chair: Neil P. Leslie, P.E., Member, Gas Technology Institute, Des Plaines, IL

This forum tries to pave a new way to find out various means and methods to factor in the concept of exergy in all aspects of sustainability of the built environment with main emphasis on HVAC systems, equipment and green cities.

Monday, June 28
11:00 A.M.-12:30 P.M.

Monday, June 28, 2010, 11:00 AM-12:00 PM

Conference Paper Session 9 (Advanced)

Alternate Cooling Technologies

Track: Energy Conservation vs. New Generation
Room: San Miguel
Chair: Taghi Alereza, Petroleum Institute, Abu Dhabi, United Arab Emirates

Abstract

1. Numerical Simulation and Experimental Study On the Performance of Screw Expander (AB-10-C023)
***Zhigang Wang**[1], Yufeng Zhang, Ph.D.[2], Lili Wei[2] and Yuexia Sun, Ph.D., Member[3], (1)Tianjin Municipal Engineering Design & Research Institute, Tianjin, China, (2)Tianjin University, Tianjin, China, (3)University of Texas at Tyler, Tyler, TX*

In this paper a new mathematical model for calculating the indicator diagram of twin screw expander is presented. The geometric parameters related to the rotation angle of male rotor are used in the model such as groove volume, suction and discharge port area, leakage area etc. The effects of internal leakage through five paths, oil injection, gas-oil heat transfer and refrigerant property are taken into account simultaneously and separately in the theoretical analyses. To verify the model and the calculated indicator diagram, experimental recording of indicator diagram of twin screw expander was carried out.

2. Solar Cooling with Concentrators (AB-10-C024)
***Sargon Ishaya, P.E., Member**, Pragmatic PE, San Jose, CA*

This paper presents simulations of the diagnostics of a conceptual data center as well as a conceptual medical office building (MOB) in various climatic regions of the United States. The paper introduces the components of a solar cooling system and how they differ from conventional systems. The simulations will be run for many different cities across the USA to determine the applicability of solar-thermal air conditioning systems for satisfying 100% of the building's cooling and heating loads.

Monday, June 28, 2010, 11:00 AM-12:00 PM

Conference Paper Session 10 (Advanced)

A Look at Building Retrofits

Track: Living with HVAC&R Systems
Room: Ruidoso
Chair: William Dietrich, Member, Baltimore Aircoil Company, Baltimore, MD

This session presents two papers discussing alternative ways to approach a building retrofit project.

1. Achieving Radically Efficient Retrofits with Integrated Energy and Financial Modeling: The Empire State Building Example (AB-10-C025)
***Caroline Fluhrer**, Eric Maurer and Aalok Deshmukh, Rocky Mountain Institute, Boulder, CO*

In order to avoid reaching unsustainable levels of atmospheric greenhouse gas (GHG) concentrations, we must reduce GHG emissions by 75% by 2050. “Deep” commercial building retrofits are an essential part of the solution. A “deep” retrofit is 1) a package of integrated, whole-building energy efficiency measures that 2) is coordinated with planned equipment replacement and that 3) optimizes cost and GHG reductions. Developing deep retrofits requires changes to the typical approach to building retrofits (which generally result in only ~15-30 percent energy savings). This paper highlights differentiators between the Empire State Building retrofit process and the typical approach to retrofits.

2. Whole-Building Retrofits: A Gateway to Climate Stabilization (AB-10-C026)
***Caroline Fluhrer**, Victor Olgyay, Member and Cherlyn Seruto, Rocky Mountain Institute, Boulder, CO*

This paper discusses the key elements of whole building retrofits, articulating key insertion points for engineers. It discusses process and technique; how to select suitable or “ripe” buildings, the key players that must be involved, the project development tasks that must be completed, and the tools and skills that engineers will need to acquire to participate in comprehensively and cost-effectively retrofitting America's commercial building stock. From this paper engineers will learn innovative and creative strategies for ensuring their work on retrofits has a far greater impact on reducing carbon emissions than it has in the past.

Monday, June 28, 2010, 11:00 AM-12:00 PM

Conference Paper Session 11 (Intermediate)

Evaluating the Performance of Existing Buildings

Track: Energy Facts vs. Simulation

Room: Mesilla

Sponsor: 02.08 Building Environmental Impacts and Sustainability

Chair: J. Kevin Cross, P.E., Member, Honeywell, Fort Collins, CO

Before developing recommendations for improving the performance of existing buildings, it is important both to gather data related to current building performance and to model current building energy use. The first paper in this session describes an on-going effort to monitor "sustainability parameters" of two existing "high performance buildings": one constructed in 2006, the other constructed in 1973. The second paper outlines a process for calibrating annual simulation models of existing buildings. The methodologies presented in the two papers are useful in assessing the performance of existing buildings generally, and in developing retrofit strategies to make those building perform better.

1. Interim Results of Monitoring and Simulating Two Existing, High Performance Buildings to Achieve and Maintain Sustainable Operation (AB-10-C027)

Janice Means, P.E., Member*, Lawrence Technological University, Southfield, MI*

Thousands of buildings have been designed and built with a goal of energy performance. However, many of these buildings offer less than desirable operating efficiencies. Through an ASHRAE Grant, a student group is instrumenting, monitoring and simulating energy use in two existing sustainable structures. This paper presents results obtained half way through this research project. The buildings under study include a three year old LEED® Silver student services center located on a Midwestern university campus and a 30 year old residential-sized structure designed to demonstrate energy conservation on a Midwestern private elementary school campus.

2. Pulling the Levers On Existing Buildings: A Simple Method for Calibrating Hourly Energy Models (AB-10-C028)

Kendra Tupper, P.E., Member, ***Darrell Hubler*** *and Erik Greensfelder, Rocky Mountain Institute, Boulder, CO*

Building retrofits require an investment grade audit in conjunction with a calibrated hourly energy model that quantifies the energy and cost implications of proposed efficiency measures. As more and more energy analysts are attempting to simulate the performance of existing buildings, a need exists for a widely applicable method for gathering data and calibrating "commodity energy models" of small to medium sized buildings where sub-metered energy use data is not available. This paper provides a user-friendly general reference for energy modelers to create accurately calibrated energy models with a minimum time investment.

Monday, June 28, 2010, 11:00 AM-12:00 PM

Conference Paper Session 12 (Advanced)

Integration

Track: Energy Facts vs. Simulation

Room: Cimarron

Chair: Philip Haves, Fellow ASHRAE, Lawrence Berkeley National Laboratory, Berkeley, CA

The session addresses two aspects of commercial building energy efficiency. The first paper presents an empirical analysis of the effect of design characteristics, climate and operation practices on the measured energy consumption of 33 office buildings in Shanghai. The second paper explores the role of the baseline or reference building in code compliance or in evaluating the expected performance of a low energy design. The effects of assumptions regarding windows, lighting, ventilation and HVAC options in defining the baseline are discussed and the effects of these assumptions on design decisions are explored.

1. Equivalent Energy Consumption of Building Energy Efficiency in Shanghai (AB-10-C029)

Haozhu Li, Student Member*, Tongji University, Shanghai, China*

This paper selects 8 building energy efficiency factors as independent variable, 3 from efficiency-non-correlated factors and 5 from efficiency-correlated factors. Among all the building energy efficiency factors, building types and management is found to have a big impact on building energy efficiency assessment based on energy use analysis of Shanghai office and commercial buildings.

2. What's My Baseline? (AB-10-C030)

Susan Reilly, Member *and Aleka Pappas, Enermodal, Inc. Industry, Denver, CO*

Energy modeling is used to compare efficiency strategies and show code compliance with an energy code relative to a baseline. The baseline reflects conventional design or a design compliant with the local energy code. To identify cost-effective, efficiency alternatives, the baseline needs to be clearly defined and understood. This paper will explore how baseline assumptions drive decisions. The differences between the Energy Cost Budget method and Appendix G baselines will be discussed, as well as real-world considerations when establishing a baseline. Examples of how assumptions for windows, lighting, ventilation, and HVAC system options affect design decisions are given.

Monday, June 28, 2010, 11:00 AM-12:00 PM

Seminar 27 (Intermediate)

Simulation of HVAC&R Components Based on Published Manufacturer Data

Track: Energy Facts vs. Simulation

Room: Brazos

Sponsor: 04.07 Energy Calculations

Chair: Michael Wetter, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

HVAC&R components operate most of the time in part load conditions for which little data are available from manufacturers. This makes performance prediction difficult. Approaches and problems are presented for simulating the performance of HVAC&R components under part load conditions and under consideration of dynamic effects such as cycling. The seminar motivates a discussion about HVAC&R component modeling for part load and dynamic conditions and it discusses what additional data are required from manufacturers to assess the performance at these conditions.

1. The Use of Semi-Empirical Modeling to Extrapolate Chiller Performance Maps

Vincent Lemort, Ph.D., Member*, University of Liege, Liege, Belgium*

In this research project, a general semi-empirical model of vapor compression chillers that could be generalized to different technologies of compressors, condensers and evaporators as well as cycle configurations was developed. The study incorporates the modeling of major types of controls of the cooling capacity. Procedures for identifying the model parameters based on published manufacturer data are described in details. These procedures require information easily available from the manufacturer submittal. It is finally showed how the proposed model can be used to extrapolate the performance maps published by manufacturers.

2. HVAC BESTEST Volume 2: Comparative Test Cases for Software That Applies Manufacturer Performance Data to Model Unitary Space Cooling Equipment

Joel Neymark, P.E., Member[1] *and Ron Judkoff, Ph.D., Member*[2]*, (1)J. Neymark and Associates, Golden, CO, (2)National Renewable Energy Laboratory, Golden, CO*

ANSI/ASHRAE Standard 140 is ASHRAE's standard method of test for evaluating building energy simulation programs. A suite of cases that was added for Standard 140-2007 is presented. These cases test the ability of simulation programs to model unitary space cooling equipment using manufacturer performance

data. The cases evaluate the ability to model the effects of varying sensible heat ratio and part load ratio, along with outside air mixing, infiltration, thermostat set up, overload conditions, and various economizer control schemes.

Monday, June 28, 2010, 11:00 AM-12:00 PM

Forum 4 (Basic)

ASHRAE Conference & Expositions Committee wants your feedback: All TC Program Chairs Welcome

Track: Professional Skills
Room: Aztec
Sponsor: Conferences and Expositions Committee
Chair: M. Ginger Scoggins, PE, Member, Engineered Designs Inc., Raleigh, NC

This forum is an opportunity to learn more about submitting papers and programs to ASHRAE's winter and annual conferences.

Monday, June 28, 2010, 11:00 AM-12:00 PM

Forum 5 (Basic)

Efficiency Ratings for Smart Equipment: Philosophy and Balance

Track: Energy Conservation vs. New Generation
Room: Dona Ana
Sponsor: 06.06 Service Water Heating
Chair: Harvey Sachs, Ph.D., ACEEE, Washington, DC

In the age of software and communications, simple efficiency metrics such as steady-state efficiency are less and less able to differentiate products whose features can deliver greater efficiency/reduced bills in service. Consider a "smart" water heater that learns usage patterns or a dual enthalpy RTU with variable capacity and an air handler that adapts to the installation ESP. Are there ways to maintain acceptable testing effort while fostering innovation and helping differentiate advance products that save much more energy? The forum is intended as one step along a path to better approaches. We hope for conversation about value and routes to help customers choose wisely and manufacturers profit from real efficiency.

Monday, June 28, 2010, 11:00 AM-12:00 PM

Forum 6 (Intermediate)

Facilities Dashboards: What Do You Want to See?

Track: Living with HVAC&R Systems
Room: Galisteo
Sponsor: 01.04 Control Theory and Application
Chair: Frank Shadpour, Shadpour Consulting Engineers, Inc., San Diego, CA

What do you want to see on your facility dashboard? Does it help me track temperature, humidity, and energy costs; or manage my energy usage? Is it an essential tool for a Net Zero Energy Building? Facility dashboards provide an interactive tool for owners and building management to explore their building's potential as well as manage its current conditions. Dashboards allow you to walk through your facility's many components to ensure the quality of your indoor environments. Come join us at this forum to find out how dashboards can change the way you view building management.

Tuesday, June 29
8:00 A.M.-9:30 A.M.

Tuesday, June 29, 2010, 8:00 AM-9:30 AM

Technical Paper Session 5 (Advanced)

Metering, Modeling, Cleaning and Climatic Studies

Track: Energy Facts vs. Simulation
Room: Ruidoso
Chair: Robert B. Risley, Member, FPL Services, Fort Meyers, FL

Presentation of technical papers.

1. Updating the ASHRAE Climatic Data for Design and Standards (RP-1453)(AB-10-011)
Didier Thevenard, Ph.D., P.E., Member[1] *and Christian A. Gueymard, Ph.D., Member*[2]*, (1)Numerical Logics Inc., Waterloo, ON, Canada, (2)Solar Consulting Services, Colebrook, NH*

Presentation of technical papers.

2. A Comparative Analysis and Validation of Two DX Cooling Coil Modeling Methods (AB-10-012)
Huojun Yang, Ph.D., Student Member[1] *and Haorong Li*[1]*, (1)University of Nebraska-Lincoln, Omaha, NE*

Two DX air cooling coil modeling methods, one used in EnergyPlus and the other termed as a generic rating-data-based (GRDB) DX coils modeling method, were summarized and their detailed calculation procedures were presented using one case study. Six rooftop models of two manufacturers were used for this study to predict sensible cooling capacity. In addition to higher accuracy and precision, the GRDB method is more robust against the variations in parameter selections, has a wider application range, requires less computation power, and is more straightforward.

3. Cleaning Initiation Criteria for Heating, Ventilation and Air-Conditioning(HVAC) Systems in Non Industrial Buildings (AB-10-013)
Jacques Lavoie*, Ali Bahloul, Ph.D. and Yves Clouttier, IRSST (Institut de recherche Robert-Sauve en sante et en securite du travail), West Montreal, QC, Canada*

In the United States and Canada, the initiation of air system cleaning is based on visual inspection, which is subjective and impractical for major cleaning work. The association for the prevention and study of contamination (ASPEC) in France has published a guide on objective sampling methods (numerical evaluation method) for keeping non-porous air systems clean.

Tuesday, June 29, 2010, 8:00 AM-9:30 AM

Technical Paper Session 6 (Advanced)

Studies on Gas-Fired and RAMEE Systems

Track: High Efficiency HVAC Systems
Room: Cimarron
Chair: Charles E. Henck, Whitman, Requardt & Associates LLP, Baltimore, MD

1. Optimal Match of Streams for Maximum Heat Transfer from a Gas-Fired Absorption Refrigeration Unit (AB-10-014)
J.V.C. Vargas, Ph.D.[1], *M.V.A. Pereira*[1], *R.S. Matos*[1], *S.C. Amico, Ph.D.*[2], *J.A.R. Parise, Ph.D.*[3] *and J.C. Ordonez, Ph.D.*[4], *(1)Universidade Federal do Parana, Curitiba, PR, Brazil, (2)Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil, (3)Pontificia Universidade Catolica do Rio de Janeiro, Rio de Janeiro, Brazil, (4)Florida State University, Tallahassee, FL*

Abstract: In this study, a 5 tons of refrigeration (60,000 BTU h-1) commercial absorption refrigeration unit was characterized and instrumented, and a simplified thermal and exergetic analysis of the system was performed, aiming the optimization of external operating parameters for maximum thermodynamic performance. The first and second law of thermodynamics were used to evaluate the energy (first law) and the exergy (second law) efficiencies of the system.

2. Crystallization Limits of LiCl-Water and MgCl2-Water Salt Solution as Operating Liquid Desiccant in the RAMEE System (AB-10-015)
Carey Simonson, Ph.D., P.E., Member*, Robert W. Besant and Mohammad Afshin, University of Saskatchewan, Saskatoon, SK, Canada*

Abstract: Avoiding crystallization in the exchangers is the main challenge in the operation of a Run-Around Membrane Energy Exchanger (RAMEE) system. In the present study, crystallization risk of two binary salt solutions (LiCl-Water and MgCl2-Water) was investigated in the RAMEE system as a novel air-to-air energy recovery device. The effect of different climatic conditions and design parameters of the system on the risk of crystallization of these two salt solutions was also studied in detail.

3. Decomposition of Formaldehyde by TiO2 Nanocatalyst Filters in the Heating, Ventilating, Air-Conditioning System (AB-10-016)
Chien Chen, Ph.D., Member*, Ching-Song Jwo, Ho Chang, Sih-Li Chen and Shin-Jr Ho, National Taipei University of Technology, Taipei, Taiwan*

This paper investigates TiO2 photocatalyst decomposition effectiveness of formaldehyde in different environment parameters. The major devices of this applicable developed by this practice set up an HVAC System chamber system according to the standard of ASHRAE. Formaldehyde with a specific concentration was initially injected into an enclosed chamber, and it circulates under the UV irradiation exposure to the TiO2 photochemical reactor. The result showed that after 2 hours of system running under the temperature set for the experiment, the photocatalyst decomposition effectiveness of Formaldehyde was 65-87%, which the photocatalyst speed will be increased along with the increase of temperature.

Tuesday, June 29, 2010, 8:00 AM-9:30 AM

Conference Paper Session 13 (Advanced)

Latest Research on Refrigeration Systems and Components

Track: Refrigeration for the Future
Room: Dona Ana
Chair: Lorenzo Cremaschi, Ph.D., Associate Member, Oklahoma State University, Stillwater, OK

Given the critical importance of energy efficiency and cost savings, modern refrigeration and heat pump systems open up to non-conventional technologies and transformative designs from the past. Papers in this session present recent developments on research areas of high-efficiency components of heat pump systems, novel refrigeration systems used for waste heat recovery, and a fundamental study of the impact of lubricant on refrigerant two-phase flow.

1. Effect of Oil on Developing Two-Phase Flow of R134a in An Air-Conditioning System (AB-10-C031)
Chad Bower, Ph.D.[1] *and Pega Hrnjak, Ph.D., Fellow ASHRAE* [2]*, (1)Creative Thermal Solutions, Inc., Urbana, IL, (2)University of Illinois at Urbana Champaign, Urbana, IL, USA, Urbana, IL*

Evaporators with parallel channels are known to suffer from maldistribution of the two refrigerant phases. This is influenced by the flow entering the manifolds. In air-conditioning systems, oil is added to ensure proper lubrication of the compressor. This paper presents an initial study of flow development of the two-phase oil/refrigerant mixture in an air-conditioning system between the expansion device and the evaporator inlet. The lubricant used in this system was a polyalkylene glycol with a nominal viscosity 46 centistokes and is miscible with liquid R134a at the temperatures examined in this study.

2. Waste Heat Powered Adsorption System to Provide Air Conditioning for Heavy-Duty Vehicles (AB-10-C032)
Yongfang Zhong, Ph.D., Associate Member[1]*, Kevin Wert, Ph.D.*[2] *and Tiegang Fang*[3]*, (1)Penn State University - Behrend, Erie, PA, (2)Thermacore, Lancaster, PA, (3)North Carolina State University, Raleigh, NC*

An adsorption refrigeration system using waste heat from diesel engines is proposed to provide cooling for heavy-duty vehicles to reduce engine emissions and fuel consumption. A model of an adsorption system using the zeolite-water working pair and powered by exhaust gas at the tailpipe is developed to simulate the transient performance. The results show that a large variation of temperature and heat transfer rate exists in the adsorber during each portion of the periodic operation. This result can provide design guidance to the optimization of system operation.

3. Performance Assessment of an Air-to-Water R-407C Heat Pump with Vapor Injection Scroll Compressor (AB-10-C033)
Luca Molinaroli[1]*, Cesare Maria Joppolo, Member*[1]*, Carlambrogio Bianchi*[2]*, Filippo Magni*[2]*, Gianluca Vecchi*[2] *and Eric Winandy, Member*[3]*, (1)Dipartimento di Energia - Politecnico di MIlano, Milano, Italy, (2)Carrier S.p.a, Villasanta (MB), Italy, (3)Emerson Climate Technologies S.A, Welkenraedt, Belgium*

The paper illustrates the performance assessment of a 20 kW air-to-water heat pump equipped with vapour injection scroll compressor and using R-407C as refrigerant. Compared to a system without vapor injection, the heat pump has higher heating capacity and COP, a nearly constant heating capacity as a function of water leaving temperature and lower compressor discharge temperature. Moreover, the heat pump working range is greatly enlarged since the system properly works with minimum air dry bulb temperature equal to -20 °C and maximum water leaving temperature equal to 65 °C.

Tuesday, June 29, 2010, 8:00 AM-9:30 AM

Seminar 28 (Intermediate)

Finding Sources to Mitigate the Cost of High Efficiency and Net-Zero Energy Systems

Track: Energy Conservation vs. New Generation
Room: Mesilla
Sponsor: 06.08 Geothermal Energy Utilization, 09.04 Applied Heat Pump/Heat Recovery Systems
Chair: Donald C. Smith, Member, Sound Geothermal Corp., Sandy, UT

The trend towards Net-Zero energy buildings is gaining momentum. Unfortunately Net Zero comes with a price. This seminar explores local and national programs that have the potential offset the cost of nm2010able and net-zero designs. Options such as nm2010able tax credits under the American Recovery and Reinvestment Act (ARRA), Clean Energy Assessment Districts (CEAD), Property Assessed Clean Energy (PACE) bonds, USDA energy financing, and Utility Assessed Clean Energy (UACE/On Bill Financing) may provide a jump start for financing additional insulation to GeoExchange heat pump systems. How these incentives may apply to an actual nm2010able system will also be presented.

1. Understanding Federal Tax Credits for Geothermal Heat Pumps
Roxanne Scott, Member*, Heat Controller, Inc., Jackson, MS*

This presentation explains the federal tax credits available for geothermal heat pumps in both residential and commercial applications, reviews the available tax incentives, eligibility factors, depreciation aspects, and the basic ins and outs pertaining to claiming this tax credit for an eligible geothermal property, as well as the option for of taking a grant in lieu of the credit on commercial installations. Also covers Energy Star, ASHRAE 90.1, and LEED changes and their affects on the industry, products, and federal tax credits pertaining to these standard initiatives.

2. New Financing Tools to Unlock Net-Zero and Renewable Energy Potential

***Paul S. Bony**, ClimateMaster Inc., Montrose, CO*

A new generation of innovative financing tools that can overcome property owners concerns that they will be unable to recover their efficiency investments if they sell their property are starting to gain traction across the US. These include loan payments on property tax bills (PACE), customized tariffs and loans paid via utility bills (on-bill financing or utility assessed clean energy, and USDA energy efficiency financing), and rebates bundled with an interest-rate buy-down option. An overview of these financing tools and examples of their application will be presented.

3. Installation Costs of Geo-Exchange Systems

***Kirk T. Mescher, P.E., Member**, CM Engineering, Inc., Columbia, MO*

Actual cost data will be presented for recent geo-exchange installations. The data will be broken down such that attendees will get a clear understanding of what the costs are for geo-exchange installations and how they might mitigate the perceived high cost of geo-exchange systems. Strategies for controlling cost will be discussed.

Tuesday, June 29, 2010, 8:00 AM-9:30 AM

Seminar 29 (Intermediate)

Standard 90.1-2010, A First Look

Track: Energy Conservation vs. New Generation

Room: Brazos

Sponsor: 07.06 Systems Energy Utilization, SSPC90.1

Chair: Keith I. Emerson, P.E., Member, Tri-State Generation and Transmission Association, Westminster, CO

Are you ready for the upcoming changes to Standard 90.1? The 2010 edition's content is being finalized at the Albuquerque meeting. From A to DH there are numerous changes since the 2007 edition that in total will save building owners a significant amount of energy. These two back to back seminars present information on the development and content of 90.1-2010.

1. The Development of 90.1-2010

***Mick Schwedler, P.E., Member**[1] and Mark Hydeman, Member[2], (1)Trane, La Crosse, WI, (2)Taylor Engineering Inc., Alameda, CA*

In this session Mick Schwedler, Chair of SSPC 90.1, will give an overview of committee goals as well as changes that have led to the soon-to-be-published ASHRAE Standard 90.1-2010. From Addenda A to Addenda TBD, numerous changes have resulted in a document that offers significant energy savings for buildings and a new definition for baseline energy efficiency in a building.

2. 90.1-2010 Envelope Highlights

***Len Sciarra, Member**, Gensler, Chicago, IL*

In this session Len Sciarra, Chair of the Envelope subcommittee, will give an overview of changes to envelope requirements for buildings conforming to the requirements of the soon-to-be published ASHRAE Standard 90.1-2010.

3. 90.1-2010 Lighting Highlights

***Eric Richman, Member**, Pacific Northwest National Laboratory, Richland, WA*

In this session Eric Richman, Chair of the Lighting subcommittee, will give an overview of changes to the lighting requirements for buildings conforming to the requirements of the soon-to-be published ASHRAE Standard 90.1-2010.

Tuesday, June 29, 2010, 8:00 AM-9:30 AM

Seminar 30 (Intermediate)

Starters and Drives: Selection Criteria, Performance Standards, Longevity

Track: High Efficiency HVAC Systems

Room: Aztec

Sponsor: 08.02 Centrifugal Machines, 01.11 Electric Motors and Motor Control

Chair: Rick M. Heiden, Trane, La Crosse, WI

Modern centrifugal chillers utilize a wide variety of motor-starting and control methods including variable speed drives. Chapter 44 of the ASHRAE Handbook HVAC Systems and Equipment briefly covers motor starters, controllers and drives but in limited detail. This seminar takes a deeper dive into chiller manufacturer recommendations for selecting, specifying and applying starters and drives for centrifugal machines. The seminar also includes comparisons of typical reliability and means to increase longevity.

1. Starter Selection, Specification and Application

***Jonathan Spreeman, Member**, Trane, La Crosse, WI*

Centrifugal chiller selection criteria can be a complicated and difficult process that will have an effect on chiller efficiency, reliability, and price. This seminar will first, focus on the advantages and disadvantages of different start types (mechanical, reduced voltage, and variable frequency drives) for both low and medium voltage motors. Secondly discuss what needs to be included in a specification to ensure the selected starter meets the customer's requirements.

2. Recent Advancements in Variable Speed Technology for Centrifugal Chillers

***Ray Good**, McQuay, Staunton, VA*

Variable frequency drive technology has steadily improved in the last decade, providing improved reliability and reduced product costs. The increased usage of variable speed chillers provides sustainable reductions in energy consumption. Recently developed technology provides further increases in variable speed chiller efficiency, through integrated design of the drive, motor, and the compressor. In addition, more robust designs allow for increased equipment uptime with the ability to re-start chillers more quickly after unplanned shut down events, and in some cases the ability to continue running during events that would shut down a conventional fixed speed chiller.

3. Integrating VFD into the System

***Larry Kouma, Member**, JCI, York, PA*

The HVAC industry has matured beyond simple efficiency improvements delivered through variable frequency drive [VFD] technology. Now the question is how to leverage the technology into integrated system solutions. How can integrated VFD technology deliver system efficiency beyond just the water chiller unit? How can VFD technology deliver SEMI-F47 compliance for chiller packages? How can VFD technology enable continued chiller operation when pumps and tower fan motors fail to perform? How can technology be integrated to enable restart and achieve chilled water temperature control in less than half the time of typical chillers?

Tuesday, June 29, 2010, 8:00 AM-9:30 AM

Seminar 31 (Intermediate)

Sustaining High Performance Buildings: ASHRAE's Role in Operations and Maintenance

Track: Living with HVAC&R Systems
Room: San Miguel
Sponsor: 07.03 Operation and Maintenance Management, GPC 32; SSPC 180
Chair: Thursten D. Simonsen, P.E., Member, Texas Facilities Commission, Austin, TX

High performance building systems continue to be more advanced and efficient, but they only perform as well as they are sustained through operations and maintenance. Building owner's, engineers, commissioning agents and other stakeholders often find actual energy performance does not meet design projections. Advanced systems are often operated inefficiently, automated systems are in manual mode and operating sequences are modified. Uptime and simplicity often outweigh energy savings. This session presents several perspectives on ASHRAE's role in educating, training, certifying and supporting the operations and maintenance staff in sustaining high performance building systems.

1. Fostering a Culture of High Performance Facility Operations
***Reed Tarkington**, Four Seasons Environmental, Inc., Monroe, OH*

How can ASHRAE make a substantial and measureable impact to reduce the carbon footprint of facilities worldwide? Existing buildings comprise 95% of the marketplace. Design opportunities in new construction and renovations effect less than 10% of the building population at a given time. How is ASHRAE focused on facilities after design and construction? Do we foster a culture of high performance facility operations? What can we do to increase awareness and facilitate solutions? One method might include ASHRAE offering facility performance benchmarking and facility performance technical certification. This presentation discusses current challenges and potential solutions regarding the existing building marketplace.

2. High Performance Buildings, Low Performance Technicians: Whose Responsibility Is It to Close the Gap?
***Richard A. Danks, Member**, NASA, Cleveland, OH*

Today's high performance buildings include sophisticated systems and complex equipment, implying smaller tolerances for acceptable maintenance and performance. Heightened demands on the technical workforce make certification attractive to building owners and operators. But which entity is best suited to develop a useful certification program for operators and technicians? Arguably, professional societies feel compelled to develop a competent workforce to get the most from these buildings. Alternately, trade schools, building trades apprenticeship programs and technical application organizations have a long history of delivering skilled workers to the market. This presentation offers a building owner/operator perspective on the development of certification programs.

3. Fundamentals for High Performance Operators
***Michael Bobker, Member**, Building Performance Lab, City University of NY, New York, NY*

A variety of programs -- LEED EBOM, BOMA BEEP, BOC and ASHRAE OPMP – reflect the new high-performance operations paradigm. Programs are reviewed and compared, finding an emerging consensus about fundamentals needed by building operators, which includes understanding of and skill sets for: Energy measurement and benchmarking, at whole-building, systems and equipment levels - Control sequences of operation, their monitoring and calibration - BAS trend logging, data plotting, and interpretation - Conditions measurement and monitoring. It is shown how these skills can be developed in classroom training curriculum supplemented by facility-based practical exercises.

Tuesday, June 29, 2010, 8:00 AM-9:30 AM

Seminar 32 (Basic)

Unique Case Studies in Acoustics

Track: Living with HVAC&R Systems
Room: Galisteo
Sponsor: 02.06 Sound and Vibration Control
Chair: Chris Papadimos, Member, Papadimos Group, San Rafael, CA

The seminar presents experiences of acoustic and vibration problems encountered in buildings associated with mechanical equipment and how they were solved. Attendees will appreciate common subtleties in equipment selection and installation and how to avoid potential pitfalls through some very simple but not so clearly obvious steps.

1. Acoustic and Structural Resonances
***Victor Wowk, P.E.**, Machine Dynamics, Inc., Rio Rancho, NM*

The acoustic resonance was a short duct section amplifying the blade passing tone of a fan that particularly bothered a blind woman in an office that relied on acoustic information to sense her surroundings. The solution was to slightly change the fan speed by re-sheaving. The structural resonance was stationary vanes vibrating on a vaneaxial fan resulting in a pure tone that was obnoxious in nearby offices. The supply fan was stopped and a bump test found the stationary blades "sung" at 193 Hz. The solution was to modify the stationary blades thus ceasing to behave as a musical instrument.

2. Transmission Loss Testing of PTAC Units
***Jon Weinstein, P.E., Member**, Industrial Acoustics Co., Inc., Bronx, NY*

Local noise code requirements can dictate acoustic performance requirements of ductless systems widely used in urban new construction and renovation projects. Noise transmission characteristics of these systems are discussed.

3. Controlling Audible Tones from Mechanical Equipment
***Roman Wowk, Student Member**, Papadimos Group, San Rafael, CA*

What possibly could noise from computer room a/c units, fan coils, laboratory exhaust fans and screw chillers all have in common? Try audible tones! While the mechanisms that produce the tonal conditions differ, the end result for the building occupants is the same – increased annoyance compared to uniform broadband noise. The contributing factors to the problem and the approach to remedial solutions will be presented with lessons learned.

4. Small Deviations and Big Failures in Vibration and Sound Isolation
***J. Byron Davis**, Vibro-Acoustic Consultants, San Francisco, CA*

The difference between design intent and actual implementation is always a problem in real constructions. For vibration and noise isolation hardware, seemingly innocuous deviations can result in major deficiencies in performance. From hardware selection to installation and adjustment, isolation systems present significant challenges. In this presentation, we offer photographs gathered over the past five years of problematic rotating systems. Categories of failure are identified, and the photographic presentation highlights subtle errors that can lead to big problems later.

Tuesday, June 29
9:45 A.M.-10:45 A.M.

Tuesday, June 29, 2010, 9:45 AM-10:45 AM

Conference Paper Session 14 (Advanced)

Clean Rooms

Track: Energy Facts vs. Simulation
Room: Ruidoso
Chair: Wei Sun, P.E., Member, Engsysco Inc., Ann Arbor, MI

1. Understanding of Flow and Scalar Fields by Combining Measured Data and CFD (AB-10-C034)
***Akira Kondo, Ph.D.**, Hiroshi Nakagawa, Akikazu Kaga and Yoshio Inoue, Osaka University, Suita Osaka, Japan*

In fluid dynamic engineering, it is important to understand both flow and scalar fields in a target area. Measurements or Computational fluid dynamics (CFD) are usually used for understanding flow and scalar fields except for simple fields which can be analytically solved and these two techniques had been independently used. Since CFD has inevitably errors accompanied by discretization and numerical calculation? CFD can't completely reproduce a complicated field. On the other hand measurements include some errors involving their method.

2. Experimental Study On the Flow and Particle Transport Induced by the Interaction Between Downwash Airflow and a Moving Object in Cleanrooms (AB-10-C035)
***Shih-Cheng Hu, Member**, National Taipei University of Technology, Taipei Taiwan, China*

In this study, we experimentally investigate the flow field and particle transport induced by the interaction between the downwash airflow and a moving object in a cleanroom having raised-floor with different porosities.

Tuesday, June 29, 2010, 9:45 AM-10:45 AM

Conference Paper Session 15 (Advanced)

Sustainability and Our Environment

Track: Living with HVAC&R Systems
Room: Cimarron
Chair: E. Mitchell Swann, P.E., Member, MDC Systems, Paoli, PA

This session will discuss the effect movement toward sustainability has on building inhabitants as we reduce energy consumption with changes to systems and equipment.

1. Low Reynolds Number Air-Flow Heat Transfer in Trapezoidally Corrugated Perforated Plate-Fin Ducts (AB-10-C036)
***Omar Huzayyin**, Ronsse Lauren and Zhao Lingying, University of Cincinnati, Cincinnati, OH*

The results of Fanning friction factor and Nusselt number over the wide range of Reynolds number covered in this study amply demonstrate the enhanced performance. Quantitatively, the enhancement is evaluated by both the area goodness factor or (j/f), and volume goodness factor, or the relative increase in (jRe) for same pumping power (fRe^3), in comparison with plain plat-fin channels.

2. Effects of Noise From Building Mechanical Systems On Elementary School Student Achievement (AB-10-C037)
***Lauren Ronsse, Student Member** and Wang Lily, University of Nebraska-Lincoln, Omaha, NE*

This project seeks to determine what relationship, if any, exists between background noise levels in elementary classrooms due to the building mechanical systems and student performance on achievement tests.

3. Wireless Control of Residential HVAC Systems for Energy Efficient and Comfortable Homes (AB-10-C038)
*Hui Li[1], **Lingying Zhao, Ph.D., Member** and Peter Ling, The Ohio State University, Columbus, OH*

This paper presents the development of a ZigBee protocol-based multi-zone HVAC control system. This wireless HVAC control system consisted of sensor monitoring nodes, airflow damper controller nodes, and a central HVAC control node. The developed ZigBee-based wireless mesh sensor and controller network was able to control multi-zone temperature quickly, accurately and stably to meet various room temperature requirements. The multi-zone climate control was estimated to provide a potential energy saving of 27.8% of heating and 38.6% of cooling energy consumption.

Tuesday, June 29, 2010, 9:45 AM-10:45 AM

Seminar 33 (Intermediate)

Efforts to Improve BIM Interoperability from Design through Operations Underway by the NIBS and CSI

Track: Professional Skills
Room: San Miguel
Sponsor: 07.01 Integrated Building Design, BIM Steering Committee
Chair: Angela Lewis, Student Member, University of Reading, Alexandria, VA

Building information modeling (BIM) is gaining interest by owners, HVAC&R designers and contractors. In order for BIM to be used seamlessly requires further development of equipment property sets for models, definitions for the use of materials, products, equipment and assemblies and facilities information handover procedures. The presenters discuss two efforts of the buildingSMART Alliance - COBie, the Construction Operations Building Information Exchange and SPie, the Specifiers' Properties Information Exchange. The presentations provide a practical overview of both of these projects, provide practical guidance on how efforts of the projects benefit the HVAC&R industry and how you can get involved in the efforts.

1. National BIM Standard, the Foundation of Interoperability
***Deke Smith**, buildingSMARTalliance, Washington, DC*

This presentation will address the role of the National BIM Standard (NBIMS) in interoperability. The presenter will discuss the items to be standardized and the process in getting there, as well as some of the projects currently being developed, such as the Construction Operations Information Exchange (COBie). The presentation will conclude with a discussion of how each person can become involved in the process and provide insight into how NBIMS fits in with the International Standards and various best business practices in development.

2. OmniClass and IFD Library: Information Organization Systems and Interoperability
***Roger Grant**, Construction Specifications Institute, Alexandria, VA*

The presentation will address how the work that the Construction Specifications Institute (CSI) is doing on OmniClass and IFD Library are creating new ways to organize information to support BIM and other object-oriented systems. The presentation will also show how projects such as the Specifiers Property information exchange (SPie) are utilizing these and other standards to provide the structured information needed to move BIM beyond visualization to analysis and operation and support the changing role of the designer and specifier.

Tuesday, June 29, 2010, 9:45 AM-10:45 AM

Seminar 34 (Advanced)

ASHRAE Members' Survival Guide: Engineering Ethics in Current Times

Track: Professional Skills
Room: Dona Ana
Sponsor: 01.07 Business, Management & General Legal Education, College of Fellows
Chair: Michael Connor, P.E., Member, Pivotal Point Group, Alpharetta, GA

A series of high profile incidents in the 1980's gave rise to an emergence of the field of ethics in the practice of engineering. Those incidents include the Challenger disaster, the Hyatt Walkway collapse in Kansas City and the Exxon Valdez oil spill. Is the membership of ASHRAE aware of their obligation to the health, safety and welfare of the public and could our profession be headed for a headline incident like those previously cited? This seminar is to bring out engineering ethical issues from the perspective of the governing board of engineering registration chartered with enforcement of engineering ethics as well as the perspective of a consulting engineer.

1. Engineering Ethics from the Perspective of Engineering Boards of Registration
***Warren Hahn, P.E., Member**, Hahn Engineering, Tampa, FL*

Boards of Registration are concerned with the practice of engineering by licensed professionals. The conduct of those individuals is regulated by State Laws as well as the Rules for the Authority of the Board. This session will focus on how the Board acts when presented with a complaint from a citizen within their jurisdiction concerning the engineering practice of a registrant and how that process works. Many times these complaints can range from "plan stamping" by a surrogate engineer to stamping of what can be considered an incomplete set of documents.

2. Engineering Ethics from the Perspective of a Consulting Engineer
***Michael Bilderbeck, P.E., Member**, Pickering, Inc., Memphis, TN*

Practicing engineers are faced with many ethical challenges. Not only are ethics surrounding professional practice to be addressed, but many consulting engineers are also business owners. Business practice ethics are frequently the challenge faced in private practice where employment issues, billing and collections as well as conflicts of interest are omnipresent issues to be addressed.

Tuesday, June 29, 2010, 9:45 AM-10:45 AM

Seminar 35 (Intermediate)

Evaporative Cooling Loves High and Dry: Case Studies and Novel Designs: Part 1

Track: High Efficiency HVAC Systems
Room: Mesilla
Sponsor: 05.07 Evaporative Cooling
Chair: Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV

Evaporative cooling has long been known to be an energy efficient means of providing cooling, and dry climates have traditionally been where evaporative systems have been most widely utilized. The introduction of indirect evaporative components, especially when combined within hybrid systems, has provided system efficiencies in excess of 30 EER, and has proven to be effective in all climates. These systems greatly enhance a building's ability to exceed the requirements of ASHRAE Standard 90.1 and to achieve LEED certification. This seminar provides examples of novel designs and technologies that incorporate the use of evaporative cooling, and examines case studies of highly efficient systems used in schools, big box retail, and institutional applications.

1. Evaporative Cooling in Big Box Retail
***James P. McClendon, P.E., Member**, Walmart Stores Inc., Bentonville, AR*

Indirect Evaporative Cooling (IDEC), while not traditionally applied, is well suited to big box retail as a low energy and cost effective alternative to mechanical cooling, particularly when applied with dedicated outside air systems (DOAS). This presentation will outline how a centralized IDEC system, with integrated waste heat recovery, can substantially lower the total annual energy consumption of a big box retail application, decrease the summer energy demand component and offset a significant portion of the annual mechanical cooling load.

2. Enhanced Evaporative Cooling Tower Design for Colder Water, Energy Savings and Reduced Evaporation
***Jarrell D. Wenger, P.E., Member**, Engineering Economics Inc., Golden, CO*

A novel two-stage evaporative cooling tower for dry ambient air conditions is described. A heat recovery system is utilized between the cooling tower discharge and intake to pre-cool warm and dry entering air to reduce its wet bulb temperature. When operated to duplicate conventional cooling tower output for a given application, fan power savings of more than 50% can be achieved along with water consumption savings of more than 30%. If the enhanced cooling tower is operated as an evaporative chiller to displace refrigeration equipment, cooling energy savings can range from 50% to more than 75%.

Tuesday, June 29, 2010, 9:45 AM-10:45 AM

Seminar 36 (Intermediate)

Retro-Commissioning: The Process and the Benefits

Track: Living with HVAC&R Systems
Room: Brazos
Sponsor: 07.09 Building Commissioning
Chair: Sarah E. Maston, P.E., Member, RDK Engineers, Andover, MA

The implementation of a retro-commissioning process will provide lasting positive results for your facility. Retro-Cx capitalizes on new technologies and strives for improved occupant comfort and indoor environmental quality while evaluating changes based on life-cycle cost.

1. Important Measures Identified After the Existing Building Commissioning Assessment
***David E. Claridge, Ph.D., P.E., Fellow ASHRAE**, Texas A&M University, College Station, TX*

Building operators and owners are accustomed to energy audits that provide a list of potential retrofits accompanied by the expected cost and savings for each measure. They then select the measures they wish to have implemented based on this listing. Our experience indicates that the initial EBCx assessment can effectively identify the overall savings expected from a existing building commissioning project, but may not effectively provide a good estimate of the savings from individual measures. In fact, some effective measures emerge only during the EBCx process.

2. Retro-Commissioning: Real Life Benefits and Experiences
***James Vallort, P.E., Member**, Environmental Systems Design, Chicago, IL*

The implementation of a retro-commissioning process will provide lasting positive results for your facility. Retro-Cx capitalizes on new technologies and strives for improved occupant comfort and indoor environmental quality while evaluating changes based on life-cycle cost. Case studies of retro-commissioning multiple buildings will also be reviewed to show some common opportunities for energy savings and IEQ improvements.

Tuesday, June 29, 2010, 9:45 AM-10:45 AM

Forum 7 (Intermediate)

Does Standard 62.1 Specify the Correct Amount of Ventilation Air for Indoor Swimming Pools?

Track: Ventilation Systems
Room: Aztec
Sponsor: 08.10 Mechanical Dehumidification Equipment and Heat Pipes
Chair: Harry Milliken, Member, DesertAire, Lewiston, ME

With today's changes in technology and advancements in water treatment, does ASHRAE 62.1 call for the correct amount of ventilation air for indoor swimming facilities? Should we have a different amount of ventilation air based on types of water treatment, bather load, or primary facility usage? Does a wet deck actually create a greater need for ventilation air? What is a wet deck? This forum presents proposed changes and solicits comments and recommendations.

Tuesday, June 29, 2010, 9:45 AM-10:45 AM

Forum 8 (Intermediate)

Source Energy vs. Site Energy: What Is the Best Metric for Standard 100?

Track: Energy Conservation vs. New Generation
Room: Galisteo
Sponsor: 07.06 Systems Energy Utilization
Chair: Michael Deru, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

This forum addresses the issues around source energy and site energy metrics for measuring building energy performance and specifically for Standard 100 (Energy Conservation in Existing Buildings). Site energy is common to building operators, is easy to measure, and provides a common metric independent of the electricity generation profile; but this metric does not get to the total energy consumption and hides the impacts of fuel switching. Source energy accounts for the total energy consumption, but it is difficult to measure, it can mask inefficiencies in the building, and it includes effects outside the control of the building operators.

Tuesday, June 29
11:00 A.M.-12:30 P.M.

Tuesday, June 29, 2010, 11:00 AM-12:30 PM

Technical Paper Session 7 (Intermediate)

Effects of Mechanical System Noise on Human Performance and Perception

Track: Living with HVAC&R Systems
Room: Dona Ana
Sponsor: 02.06 Sound and Vibration Control, 02.01 Physiology and Human Environment
Chair: Kenneth P. Roy, Ph.D., Member, Armstrong World Industries, Lancaster, PA

This session presents the findings of two recent ASHRAE-sponsored projects that focused on the mechanical system noise in buildings, and the effects on human performance and perception. First, 1128-RP investigated how the noise levels and thermal conditions may interact to affect human performance and perception. Secondly, 1322-RP investigated the effects of ill-behaved noise, specifically conditions with tonal components or time-varying fluctuations, and discusses how the results can impact the indoor noise criteria listed in the ASHRAE HVAC Applications Handbook.

1. Combined Effects of Noise and Temperature On Human Comfort and Performance (1128-RP) (AB-10-017)
Dale Tiller, Ph.D.[1], *Lily Wang, Ph.D., P.E., Member* [2], *Amy Musser, Ph.D., P.E., Member*[3] *and Matthew J. Radik*[4], *(1)University of Nebraska, Lincoln, Lincoln, NE, (2)Architectural Engineering, University of Nebraska - Lincoln, Omaha, NE, (3)Vandemusser Design, PLLC, Asheville, NC, (4)Union Pacific Railroad, Omaha, NE*

This paper presents the results of an investigation into the combined effects of noise from building mechanical systems and temperature on human comfort and performance.

2. The Effects of Noise From Building Mechanical Systems with Tonal Components On Human Performance and Perception (1322-RP) (AB-010-018)
Erica Ryherd, Ph.D., Member[1] *and Lily Wang, Ph.D., P.E., Member* [2], *(1)Georgia Institute of Technology, Atlanta, GA (2)University of Nebraska - Lincoln, Omaha, NE*

This paper presents the results of an investigation of noise from building mechanical systems with tonal components on human task performance and perception.

3. Human Performance and Perception-Based Evaluations of Indoor Noise Criteria for Rating Mechanical System Noise with Time-Varying Fluctuations (1322-RP) (AB-10-019)
Lily Wang, Ph.D., P.E., Member [1] *and Cathleen C. Novak*[2], *(1)Architectural Engineering, University of Nebraska - Lincoln, Omaha, NE, (2)PMK Consultants, Dallas, TX*

This paper presents the results on an investigation of noise from building mechanical systems with time-varying fluctuations on human task performance and perception. It also discusses how the overall findings of 1322-RP impact the indoor noise criteria ratings listed in the ASHRAE HVAC Applications Handbook.

Tuesday, June 29, 2010, 11:00 AM-12:30 PM

Technical Paper Session 8 (Advanced)

Heat Transfer, Transducers, TiO2 and CFD

Track: Energy Facts vs. Simulation
Room: Cimarron
Chair: Robert B. Risley, Member, FPL Services, Fort Meyers, FL

Presentation of technical papers.

1. Development of An Energy Meter Using a Pump Flow Station (AB-10-020)
Gang Wang, Ph.D., P.E., Member[1], *Mingsheng Liu, Ph.D., P.E., Member*[2] *and David E. Claridge, Ph.D., P.E., Fellow ASHRAE*[3], *(1)Texas A & M University, Kingsville, TX, (2)University of Nebraska, Omaha, NE, (3)Texas A&M University, College Station, TX*

This paper presents the theoretical model of pump flow stations based on measured pump head and motor power, and the experiments and results of a cooling energy meter using a pump flow station developed on the chilled water system at a facility.

2. System Analysis of MPCM Slurry Enhanced with Carbon Nanotubes as Heat Transfer Fluid (AB-10-021)
Jorge Alvarado, Ph.D., P.E., Member and ***Hessam Taherian****, Texas A & M University, College Station, TX*

Microencapsulated phase change material (MPCM) and carbon-nanotube based nanofluids have both been investigated as heat transfer coefficient enhancers separately. In this paper, we investigate the potential manifold benefit of using a blend of both as a new heat transfer fluid. The effect of percentage of MPCM that undergoes phase change and the composition of the new blend of heat transfer fluid have been investigated. A computer simulation code reveals that the best composition for the MPCM-nanofluid blend depends on the actual percentage of phase change that takes place in the process.

3. To Assess the Validity of the TFM: a Neural Model for the Optimal Choice of Conduction Transfer Functions (AB-10-022)
Marina Mistretta, Ph.D.*[1], Maurizio Cellura, Ph.D.[2], Valerio Lo Brano, Ph.D.[2] and Aldo Orioli[2], (1)Universita degli Studi Mediterranea, Reggio Calabria, Italy, (2)Universita degli Studi di Palermo, Palermo, Italy*

This paper presents a new mathematical approach applied to Conduction Transfer Functions (CTFs) of a multilayered wall to predict the reliability of building simulations based upon CTFs.

4. Evaluation of CFD for Simulating Air Pollutant Dispersion around Buildings (AB-10-023)
Ted Stathopoulos, Ph.D., P.E., Member*[1] and Bert Blocken, Ph.D.[2], (1)Concordia University, Montreal, QC, Canada, (2)Eindhoven University of Technology, Eindhoven, Netherlands*

The distribution of air pollutant concentrations around buildings is a main concern of building and air-conditioning engineers that design the ventilation inlets and outlets on building facades or roofs. CFD is increasingly used to predict air flow and related processes around buildings. In this paper, some possibilities and limitations of CFD for simulating air pollutant dispersion around buildings are discussed. The focus is on dispersion around an isolated building, as the generic basic case for dispersion in the urban environment.

Tuesday, June 29, 2010, 11:00 AM-12:30 PM

Seminar 37 (Basic)

20th Century Ethics Are Not Relevant in the 21st Century: A Debate

Track: Professional Skills
Room: Aztec
Sponsor: College of Fellows, 01.07 Business, Management & General Legal Education
Chair: Carl N. Lawson, Fellow ASHRAE, Hanson Professional Services Inc, Maitland, FL

This is the second of the College of Fellows debate series. Opposing teams present the initial arguments on both sides of the moral and ethical dilemma. The audience will then join in the debate. Changes in the codes and practice of ethics occurred at the beginning and end of the Victorian era and again toward the end of the 20th century. Changes in the way buildings are procured and used together with new emphasis on inter professional practice, financial drivers, transparency, sustainability and insurance drive a new approach to ethics – or do they?

1. For 20th Century Ethics' Relevancy
Larry Spielvogel, P.E., Fellow Life Member*, Consulting Engineer, King of Prussia, PA*

Presents an argument for the relevancy of 20th Century ethics in the 21st Century.

2. Against 20th Century Ethics' Relevancy
Richard Rooley, Presidential Fellow Life Member*, Rooley Consultants, Stoke Poges, Buck, United Kingdom*

Presents an argument against the relevancy of 20th Century ethics in the 21st Century.

3. For 20th Century Ethics' Relevancy
E. Mitchell Swann, P.E., Member*, MDC Systems, Paoli, PA*

Presents an argument for the relevancy of 20th Century ethics in the 21st Century.

4. Against 20th Century Ethics' Relevancy
Victor Goldschmidt, Fellow ASHRAE*, Consultant, Northport, MI*

Presents an argument against the relevancy of 20th Century ethics in the 21st Century.

5. For 20th Century Ethics' Relevancy
Rodney Lewis, P.E., Fellow Life Member*, Rodney H. Lewis Associates, Inc., Houston, TX*

Presents an argument for the relevancy of 20th Century ethics in the 21st Century.

6. Against 20th Century Ethics' Relevancy
Gloria Cofer*, Executive Assistant to ASHRAE Board of Directors, Atlanta, GA*

Presents an argument against the relevancy of 20th Century ethics in the 21st Century.

Tuesday, June 29, 2010, 11:00 AM-12:30 PM

Seminar 38 (Intermediate)

ASHRAE's Building Energy Quotient Program: Pilot Program Update

Track: Professional Skills
Room: Ruidoso
Sponsor: Building Energy Labeling
Chair: Ronald Jarnagin, Member, Pacific Northwest National Laboratory, Richland, WA

In December 2009 ASHRAE launched the Building Energy Quotient (bEQ) program for the energy performance labeling of commercial buildings. The bEQ program will include both an asset rating, based on simulated performance of a building (new or existing) as designed and independent of operation, and an operational rating based on measured energy use and Internal Environmental Quality data. The label will focus on a rating system and methodology in which the best scores indicate net zero energy buildings. In early 2010, a pilot program was launched to establish and test the operational (In Operation) rating on 20-25 selected buildings. In the summer and fall of 2010 a similar pilot program will test the asset (As Designed) rating. This seminar begins with an overview of the bEQ label and supporting documentation, the labeling process, and the pilot program for the operational rating. This is followed by a presentation describing the development process for the upcoming asset rating pilot program. Finally, a case study or two illustrates the experience of assessors who have applied the bEQ operational rating to selected buildings.

1. Development of ASHRAE's Building Energy Quotient Labeling Program
Harry Misuriello, Member*, American Council for an Energy Efficient Economy, Arlington, VA*

This session recounts the efforts of the Ad-Hoc Committee to develop the Building Energy Quotient labeling program over the past two years. The Society's underlying belief is that public display and disclosure of the energy efficiency attributes of a building and its energy use intensity (EUI), in combination with real estate market forces, will lead building owners to strongly consider cost-effective energy efficiency improvements at the time of design and construction and in any

subsequent renovations. We review the Committee's development of the recommended labeling procedures, reviewing precedent in the United States and internationally, and the technical and policy issues.

2. Building Energy Quotient Asset Rating and Pilot Program
***Daniel Nall, P.E., Member**, WSP Flack + Kurtz, New York, NY*

Major components and issues of the Asset Rating portion of the bEQ standard are discussed. The Asset Rating is a measure of the energy efficiency quality of the as-built fixed physical components of a building. It differs from the current LEED Energy and Atmosphere Credit 1, that has a similar aim, in that it allows comparison among similar buildings, within a size range and of the same occupancy type within a climate zone. The Asset Rating is designed to have a particular relevance for real estate transactions, because it expresses an integral measure of the building's inherent energy efficiency.

3. Building Energy Quotient Operational Rating Pilot Case Study of Building in Portland, Oregon
***Peter D'Antonio, P.E.**, PCD Engineering, Longmont, CO*

Building Energy Quotient (bEQ) program - Operational Rating Case Study. What do engineers and building owners and operators need to know about ASHRAE's bEQ operational (in operation) rating process? How does the bEQ operational rating program compare to other building rating systems, such as Energy Star and LEED? Peter will answer those questions and present valuable information and lessons learned through a case study of an office building that recently underwent a rating in Portland, OR.

Tuesday, June 29, 2010, 11:00 AM-12:30 PM

Seminar 39 (Intermediate)

Evaporative Cooling Loves High and Dry: Case Studies and Novel Designs, Part 2

Track: High Efficiency HVAC Systems
Room: Mesilla
Sponsor: 05.07 Evaporative Cooling
Chair: Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV

Evaporative cooling has long been known to be an energy efficient means of providing cooling, and dry climates have traditionally been where evaporative systems have been most widely utilized. The introduction of indirect evaporative components, especially when combined within hybrid systems, has provided system efficiencies in excess of 30 EER, and has proven to be effective in all climates. These systems greatly enhance a building's ability to exceed the requirements of ASHRAE Standard 90.1 and to achieve LEED certification. This seminar provides examples of novel designs and technologies that incorporate the use of evaporative cooling, and examines case studies of highly efficient systems used in schools, big box retail, and institutional applications.

1. A Hybrid Evaporatively Cooled HVAC System for A New School in Albuquerque
***Michael S. Sherber, P.E., Member**, The Firma Group, Avon, CT*

This presentation is about the HVAC system design of a new 32,000 SF elementary school in Albuquerque employing an innovative hybrid direct/indirect evaporatively cooled (with supplemental DX) HVAC system. The system will also provide 100% highly filtered outside air for superior indoor air quality without terminal reheat. This system design was chosen to meet the Albuquerque Public Schools desire for an extremely energy efficient HVAC system which is likely to perform up to design and that also is easier to maintain than the multitude of existing rooftop unitary direct evaporative coolers found in many of its schools.

2. Climate-Specific Evaporative Packaged AC
***James V. Dirkes II, P.E., Member**, The Building Performance Team, Grand Rapids, MI*

Packaged AC equipment misses a great opportunity for dramatically higher efficiency by remaining "generic" and independent of climate. "The Western Cooling Challenge", sponsored by the WCEC of UC Davis provided proof of this when new indirect evaporative cooling equipment designed specifically for hot, dry climates achieved EER ratings of between 22 and 42. This presentation will include detailed information about the straightforward technology approach which enabled these dramatic EERs, as well as performance data from one of the first installations.

3. Evaporative Cooling at Las Vegas Springs Preserve – A LEED Platinum Building
***Bryan Im, P.E., Member**, Norman S. Wright Mechanical, Las Vegas, NV*

Case study at a LEED Platinum installation where evaporative cooling provides the primary source of cooling in a very hot and dry Las Vegas climate at 2200' elevation. The presentation will cover changes to the initial system design to evaporative cooling, challenges to the project, design of the air handler and performance data.

Tuesday, June 29, 2010, 11:00 AM-12:30 PM

Seminar 40 (Basic)

Issues Update: Hot Topics in Public Policy

Track: Professional Skills
Room: San Miguel
Sponsor: Advocacy Committee
Chair: Doug Read, Associate Member, ASHRAE, Washington, DC

Policymakers continue to focus on issues important to ASHRAE members including energy, environment, sustainability and education. In order to be engaged in the policy process and to identify future needs and opportunities, ASHRAE members must be aware of how government action can affect their practice. Experts from within and outside ASHRAE will report on the latest policies of interest to ASHRAE members

1. Energy Efficiency and Buildings Policy in the Southwest
***Jim Meyers**, Southwest Energy Efficiency Partnership, Albuquerque, NM*

Across the country, states and localities are taking the lead in establishing initiatives to tackle climate change and reduce energy use. Green building programs, updated building codes, incentive programs and utility initiatives are among the efforts. This presentation will focus on how these and other initiatives are being implemented in the Southwest.

2. On the Hill: Energy and Climate Policy
***Patricia Dominguez**, Office of Senator Jeff Bingaman, Albuquerque, NM*

Congress is in the midst of discussions related to energy and climate policy. This presentation will provide a first hand look at how the discussions are progressing and what ASHRAE members can expect in the near future.

3. The ASHRAE View On Washington
***Doug Read**, ASHRAE, Washington, DC*

Many of the actions and activities of the federal government impact ASHRAE members. Particularly with the increased focus on energy efficiency and green buildings the need for our expertise is significant. This presentation will discuss current legislation and regulation potentially affecting ASHRAE members.

Tuesday, June 29, 2010, 11:00 AM-12:30 PM

Seminar 41 (Advanced)

Natural Refrigerants: A Roadmap to Refrigeration for the Future

Track: Refrigeration for the Future
Room: Galisteo

Sponsor: 03.01 Refrigerants and Secondary Coolants, Refrigeration Committee, 10.07 Commercial Food and Beverage Cooling Display and Storage

Chair: Georgi S. Kazachki, Ph.D., Fellow ASHRAE, DRS Technologies, Florence, KY

Natural refrigerants, such as ammonia, water, hydrocarbons, and in many applications CO2, yield superior thermodynamic performance in vapor-compression cycles. Constantly advancing system design practices and component enhancements successfully extend the thermodynamic efficiency into superb system efficiency while maintaining simplicity and cost competitiveness. The presentations at this seminar provide illustrations of cost-effective and energy efficient design practices in a variety of refrigeration and air-conditioning applications with considerations for minimized annual energy consumption for the lifetime of the equipment with no performance degradation.

1. The Future Energy Efficiency in USA Office Buildings and Hospitals Using Total Energy NH3 and CO2 Systems for Heating and Cooling
***Klaas Visser, Member**, KAV Consulting Pty Ltd, Kangaroo Flat, Australia*

HFC refrigerants are offering a solution to the Ozone Depletion associated with CFC and HCFC refrigerants. The Global Warming Potential of the new HFC family of refrigerants is now becoming an increasing concern. The other issue is the energy consumption for both heating and cooling of buildings. A solution to both these problems is possible by reviving the use of the natural refrigerants Ammonia (NH3) and Carbon Dioxide (CO2). The presentation demonstrates the benefits of NH3 and CO2 systems for both cooling and heating of large buildings in terms of energy efficiency and GWP = 0 and 1, respectively.

2. Design and Performance Evaluation of a Cascade CO2 Refrigeration System in a Supermarket Application
***Masood Ali, Member** and Travis Limpkin, Kysor Warren, Columbus, GA*

Design of CO2 refrigeration system for Supermarkets imposes design challenges for energy efficiency, safety and reliability. Field test is carried out on a Supermarket with a design refrigeration load of 830,000 Btu/h, catering to MT load on CO2 secondary system and LT load on CO2 Dx system. The entire system is designed with state-of-the-art energy efficient features. A brief overview of relief scenarios and design considerations and test results are presented. A data analysis of the system in operation is performed and compared with design objectives. Complete analysis of energy and performance for one year of operation would be presented.

3. Operation of R-744 Environmental Control Units at High-Ambient Temperatures
***Predrag S. Hrnjak, Ph.D., Fellow ASHRAE**, University of Illinois at Urbana-Champaign, Urbana, IL*

A number of US Army Environmental Control Units have been converted to R-744 as the refrigerant. A major concern has been the operation at high ambient temperatures of up to …°F from both capacity and efficiency points of view. This presentation will show an excellent performance compared to the baseline operation with R-134a along with an interpretation of the results exceeding the expectations.

4. CO2 Heat Pump Water Heater Performance
***Yunho Hwang, Ph.D., Member**, University of Maryland, College Park, MD*

A CO2 heat pump water heater breadboard facility was built, and a performance evaluation was conducted to investigate the effects of ambient temperature and the temperature of water entering the gas cooler in relation to the the heating capacity and COP during tank reheating tests. Analysis was based on typical water usage for the residential water heating application. In the experiment, tap water temperature was moderated according to the ambient temperature in order to mimic real operating conditions. Results show that the water heating capacity and COP were maximized at higher ambient temperatures and at lower hot water temperatures.

Tuesday, June 29, 2010, 11:00 AM-12:30 PM

Seminar 42 (Intermediate)

Standard 90.1-2010, A First Look (continued)

Track: Energy Conservation vs. New Generation

Room: Brazos

Sponsor: 07.06 Systems Energy Utilization, SSPC 90.1

Chair: Keith I. Emerson, P.E., Member, Tri-State Generation and Transmission Association, Westminster, CO

Continuing the first look at ASHRAE / IES Standard 90.1-2010, this seminar goes over changes to the lighting requirements, the energy cost budget trade-off procedure with associated Appendix G, how the determination of energy savings will be made for the Department of Energy and where the Standard might go from here.

1. 90.1-2010 Mechanical Highlights
***Drake H. Erbe, Member**, Airxchange, Inc., Rockland, MD*

In this session Drake Erbe, Chair of the Mechanical subcommittee, will give an overview of changes to the mechanical requirements for buildings conforming to the requirements of the soon-to-be published ASHRAE Standard 90.1-2010.

2. 90.1-2010 Energy Cost Budget Highlights
***Jason Glazer, P.E., Member**, GARD Analytics, Inc., Arlington Heights, IL*

In this session Jason Glazer, Chair of the Energy Cost Budget subcommittee, will give an overview of changes to both Section 11 Energy Cost Budget and Appendix G Performance Rating Method of the soon-to-be published ASHRAE Standard 90.1-2010.

3. 90.1-2010 Energy Saving Analysis
***Bing Liu, P.E., Member**, Pacific Northwest National Laboratory, Richland, WA*

The 90.1 committee has set up a work plan goal for 90.1-2010 to achieve the 30% energy cost savings compared with 90.1-2004. This session covers how the new requirements of ASHRAE Standard 90.1-2010 are being modeled and analyzed to measure the progress towards the goal.

4. 90.1-2013: What's Ahead for 90.1?
***Stephen V. Skalko, P.E., Member**, Portland Cement Association, Macon, GA*

Standard 90.1-2010 will be finalized by the close of this annual meeting. Where do we go from here? What new challenges are facing the 90.1 committee? The incoming chair of the 90.1 committee will present potential answers to these questions.

Wednesday, June 30
8:00 A.M.-9:30 A.M.

Wednesday, June 30, 2010, 8:00 AM-9:30 AM

Seminar 43 (Intermediate)

Commissioning Certifications: Which Is Which?

Track: Living with HVAC&R Systems
Room: Mesilla
Sponsor: 07.09 Building Commissioning
Chair: Sarah E. Maston, P.E., Member, RDK Engineers, Andover, MA

The commissioning industry has developed several commissioning provider certifications sponsored by many different organizations, including ASHRAE, the University of WI, NEBB, ACG and BCA. Join us as these organizations highlight the benefits and requirements of each certification program.

1. Commissioning Certifications Sponsored by the University of WI
***Joy E. Altweis, P.E.**, University of Wisconsin, Madison, WI*

The University of Wisconsin—Madison, Department of Engineering Professional Development offers individuals the opportunity to gain a marketable, independently recognized certification as a professional knowledgeable in the commissioning process. Three unique certifications offer applicants recognition for their skills, through a combination of training, examination, and proof of professional experience. This presentation will explain the available certifications and qualification requirements.

2. Commissioning Certification Sponsored by AABC Commissioning Group (ACG)
***Jim Magee, Associate Member**, Facility Commissioning Group, Nicholasville, KY*

Jim will be presenting on the qualifications and benefits of the commissioning certification sponsored by AABC Commissioning Group (ACG), the Certified Commissioning Authority (CxA) Requirements to take the exam include technical experience (professional engineer, registered architect, or certified test and balance engineer, or a minimum of 8 years); commissioning experience (3 projects serving as a commissioning provider, with specific roles and responsibilities and client contact information); and independent role in the process. The applicants then take the CxA Exam.

3. Commissioning Certification Sponsored by BCA
***Bryan Welsh, P.E.**, Welsh Commissioning Group, Auburn, WA*

The Certified Commissioning Professional (CCP) certification is the premier certification for commissioning providers. CCPs don't just understand the process, they've performed the process. To qualify for the CCP exam, the applicant must meet requirements that include a minimum number of years as a Cx professional and provide three projects with client references that total at least 150,000 square feet and $30 million in construction value. Certification is good for a period of three years and is nm2010able. The test is offered online in more than 200 locations.

4. Commissioning Certification Sponsored by NEBB
***Stephen Wiggins** , Newcomb & Boyd, Atlanta, GA*

NEBB Certification is a detailed and demanding process. Individuals cannot apply for NEBB certification, only firms are eligible for NEBB certification which must designate a professional, a NEBB Certified Professional, within their firm to supervise all NEBB related work. NEBB Certified Professionals must have extensive experience, plus they must pass appropriate, college-level written examinations. In certain disciplines, NEBB Certified Professionals must demonstrate practical working knowledge and proficiency in the use of instruments.

5. ASHRAE's Commissioning Certification
***Gerald J. Kettler, P.E., Life Member**, AIR Engineering and Testing, Dallas, TX*

The ASHRAE commissioning certification is called the Commissioning Process Management Professional or CPMP. The purpose of the ASHRAE certification program is to assist building owners, developers, standards writing agencies, and others in assessing the capability of individuals to manage the whole building commissioning process with the owner. The certification is obtained by completing an application, having the proper experience, and completing a 115 question examination to demonstrate a comprehensive knowledge of the commissioning process and its deliverables.

Wednesday, June 30, 2010, 8:00 AM-9:30 AM

Seminar 44 (Intermediate)

Energy Efficiency Impacts of New Codes and Standards for Refrigerated Facilities

Track: Refrigeration for the Future
Room: Galisteo
Sponsor: 10.05 Refrigerated Distribution and Storage Facilities
Chair: David Cowen, Member, Food Service Technology Center, San Ramon, CA

Federal prescriptive standards for walk-in coolers and freezers will give way to performance based standards. Federal Standards, California's Title 20 and Title 24 as well as AHRI Standard 1250 look to improve energy efficiency for large scale refrigerated facilities all the way down to small walk-in coolers/freezers. The AHRI standard includes a performance-based method of test, which will become the metric for the Federal Standard in 2012. Find out what the new standards and test method mean to you and how it will affect existing and new building designs.

1. The Federal Standards Rulemaking Process and Status as It Relates to the Walk-in Coolers and Freezers Energy Conservation Standards Rulemaking
***Aris Marantan, Member**, Navigant Consulting, Washington, DC*

This presentation will describe the federal standards rulemaking process and status as it relates to the walk-in coolers and freezers energy conservation standards rulemaking. The presentation will describe the design requirements mandated by the Energy Independence and Security Act (EISA) and describe the process DOE will follow for the standards rulemaking on walk-in coolers and freezers.

2. AHRI Standard 1250 Method of Test and the Role It Plays in the Walk-in Coolers and Freezers Energy Conservation Standards Rule Making
***Xudong Wang, Member**, Air-Conditioning, Heating and Refrigeration Institute (AHRI), Arlington, VA*

The DOE proposes to adopt the AHRI Standard 1250-2009, Performance Rating of Walk-In Coolers and Freezers, that applies to mechanical refrigeration equipment consisting of an integrated single package refrigeration unit, or as separate unit cooler and condensing unit sections, where the condensing unit can be located either outdoors or indoors. How will this impact the operation and installation of walk-in coolers/freezers?

3. California's Title 20 and 24 Appliance Efficiency Standard for Walk-in Refrigeration and Refrigerated Warehouses
***David Wylie**, ASW Engineering, Tustin, CA*

The Energy Independence and Security Act of 2007 (EISA) set Federal efficiency standards for walk-in coolers and freezers less than 3,000 sf. EISA specifically allows California to develop more stringent CA Title 20 appliance efficiency standards in 2011 for walk-in refrigeration. This presentation will cover the findings of a technical and economic evaluation of various walk-in refrigeration efficiency measures under consideration for inclusion into this efficiency regulation that will impact all walk-ins sold in California.

Wednesday, June 30, 2010, 8:00 AM-9:30 AM

Seminar 45 (Intermediate)

Hospital Energy Benchmarking

Track: Energy Facts vs. Simulation
Room: Aztec
Sponsor: 09.06 Healthcare Facilities
Chair: Ronald L. Westbrook, P.E., Member, State University of New York, Upstate Medical University, Syracuse, NY

As the sustainability movement matures it is evident that there is a need for understanding how and where in a facility is the energy being used. That is certainly true for the energy diverse facilities such as hospitals. The information being presented at this seminar includes updates on hospital benchmarking activities being sponsored by the DOE and DOD and currently supported by ASHRAE TC 9.6. The information will be vital to energy simulation validation.

1. Results of Energy Audits of Four Military Hospitals
*Dan Koenigshofer, P.E., Member[1] and **John Roberts, P.E., Member**[2], (1)IES Engineers - Dewberry, Chapel Hill, NC, (2)IES Engineers, Chapel Hill, NC*

Energy and water audits were conducted at 4 military hospitals in the US. Each was modeled using Trane Trace based on actual energy use and field measurements. Metrics presented include: BTU/SF/Yr, breakdown of energy use by function, water use gal/bed/yr, energy $/bed/yr, and comparison of total energy use by 25 hospitals. Energy conservation opportunities will be discussed along with estimated savings, cost, and implementation strategies.

2. Quantifying the Energy Consumption of Hospital Medical Devices and Plug Loads
***Brett Singer, Ph.D., Member**, Lawrence Berkeley National Laboratory, Berkeley, California*

Quantifying energy use in health care facilities provides a valuable overall picture of performance. Facility energy consumption by heating, cooling, lighting, and process equipment is categorized and analyzed using carefully selected performance metrics. The resultant data can be used for improving performance modeling that designers can employ to create higher performing facilities; for improving building automation systems settings to improve building performance and reduce energy use. The presentation will cover system level performance metrics and benchmarks relevant to Hospitals and describe some of remedial actions that can be taken when those benchmarks are exceeded.

3. Energy Star Ratings of Healthcare Facilities: Benefits Beyond the Score
***Michael Meteyer, P.E., Member**, Cogdell Spencer ERDMAN, Madison, WI*

What can the facility owner, managers, and designers interpret from the Energy Star rating program and how can it be used to improve facility performance in Hospitals and Health Facilities? This program describes the factors used in assembling the data that Energy Star uses to develop the analysis, and the methodology used by the Portfolio Manager to determine the rating score, and present examples from case studies where facilities have implemented system upgrades to improve their rating scores.

Wednesday, June 30, 2010, 8:00 AM-9:30 AM

Seminar 46 (Intermediate)

Integrating the Principles of Standard 62.1 into Design and Operation for LEED, 189.1 and Sustainable, Efficient Buildings

Track: Ventilation Systems
Room: Brazos
Sponsor: SSPC 62.1
Chair: Jeff K. Smith, Georgia Power Co, McDonough, GA

This seminar addresses the interplay between meeting the requirements of Standard 62.1, obtaining LEED accreditation, 189.1 and sustainable buildings. It also focuses on sustainability in commercial buildings. Speakers discuss the various assumptions used in solving the multiple space equation in 62.1 as well as variable air volume issues that arise around 62.1 and LEED certification. Additionally, case studies on ventilation of LEED certified buildings are discussed.

1. What Assumptions Must Be Used in Solving the Multiple Space Equation in 62.1
***Hoy Bohanon, P.E., Member**, Working Buildings, Winston-Salem, NC*

The multiple space equation in Standard 62.1 contains two compliance paths, Table 6-3 and Appendix A. What are the differences? Are there two different answers? What happens when you have a VAV system and the airflows change? Is the ventilation required for constant volume and VAV systems the same? What about DOAS?

2. VAV Issues
***Dennis Stanke**, Trane Commercial Systems, Ingersoll Rand, La Crosse, WI*

Discussed are many of the issues that arise in variable air volume systems as it pertains to Standard 62.1 and LEED certification.

3. Case Studies on Ventilation of LEED Buildings
***Michael Apte, Ph.D., Member**, Lawrence Berkeley National Laboratory, Berkeley, CA*

Reviewed are multiple case studies of LEED certified buildings and the interplay of ventilation in the process.

Wednesday, June 30, 2010, 8:00 AM-9:30 AM

Seminar 47 (Intermediate)

Modeling Thermal Radiation in the Indoor Environment

Track: Energy Facts vs. Simulation
Room: Cimarron
Sponsor: 04.10 Indoor Environmental Modeling
Chair: James VanGilder, P.E., Member, APC by Schneider Electric, Billerica, MA

Airflow simulation is ever-increasingly being employed to improve energy efficiency while meeting goals for occupant comfort and health. Although an important consideration, thermal radiation is difficult to model and is often ignored in indoor environment simulations. Thermal radiation not only directly affects thermal comfort but it may also substantially alter the air temperature distribution in the space and, to some degree, affect airflow patterns. This seminar considers topics ranging from the implementation of radiation models in indoor-environment simulations to the net effect on thermal comfort in various applications.

1. Thermal Radiation in Enclosed Glazed Public Pavilions and Its Impact in the Design
***Greg Sanchez**, MTA-New York Transit, New York, NY*

Modern public spaces are designed with lots of glass structures, creating the environment very dependant on the reduction of the solar gains. As we try to design green buildings, more natural light is desired, but the thermal load, which is a function of lights and sun rays, will impact the concept. This seminar will present a case study of a pavilion used for public access and designed to be naturally ventilated. Solar and light heat gains are accounted for and modeled using CFD. This seminar will identify challenges and methods used to establish a feasible design and meet comfort guidelines.

2. Neglecting Radiative Heat Transfer in Computational Fluid Dynamics
Jackie Russo *and Ryan Dygert, Syracuse University, Syracuse, New York*

It is common practice to neglect radiative heat transfer and model half the heat loss through convective heat transfer to avoid perceived difficulties associated with radiation calculations. Neglecting half the heat loss can cause error due to non-linear coupling of radiant and convective heat transfer. This assumption was tested for various boundary conditions for a single manikin in a displacement ventilated room: radiant and convective heat flux, convective heat flux only, and surface temperatures. Compared to experimental data, modeling radiant and convective heat flux produced satisfactory results. Other boundary conditions can be used on a case to case basis.

3. Modeling Thermal Radiation from a Fire Wall
Xudong Yang, Ph.D., Member*, Tsinghua University, Tsinghua, China*

Fire walls have been widely used in rural China to heat the house in winter. However, its thermal performance has ot been well studied. In this study, we constructed a full-scale experimental set up of a fire wall, and measured its heat transfer characteristics in winter. A model was developed to consider both the convective and radiation heat transfer from the fire wall. Suggestions to enhance the heat utilization efficiency were made based on the modeling results.

Wednesday, June 30, 2010, 8:00 AM-9:30 AM

Seminar 48 (Intermediate)

Solving Moisture Problems Created By Energy Efficient Design

Track: High Efficiency HVAC Systems
Room: San Miguel
Sponsor: 04.04 Building Materials and Building Envelope Performance, 01.12 Moisture Management in Buildings
Chair: Alex McGowan, P.Eng., Member, Levelton Consultants Ltd., Victoria, BC, Canada

A building envelope that deteriorates over time and must be replaced is neither green nor sustainable. Excess moisture that causes dehumidifiers to work overtime is not energy-efficient. In some cases, however, energy-efficient design (high insulation levels, setback thermostats, airtight building envelopes, etc.) creates problems with moisture control. This seminar shows the link between energy-efficient design and moisture concerns, and presents guidance for preventing problems that reduce the durability of the envelope or overwork the mechanical equipment. A group of dynamic speakers from a variety of backgrounds show current research, theory, design, and real-life approaches to solving this problem.

1. Moisture and the Energy Efficient Building Envelope: Fundamentals
Rick Peters, P.E.*, TBS Engineering, Inc., Bainbridge Island, WA*

The concerted effort towards higher energy efficiency has resulted in buildings with increased insulation and airtightness, in addition to high-efficiency (and low-capacity) HVAC equipment. In doing so, we have limited our ability to control moisture levels within the envelope. The energy once utilized to de-humidify interior spaces is simply not available. This seminar re-acquaints the audience with the fundamentals of heat and mass transfer associated with this phenomenon, to help identify when a problem may exist and to provide the tools to explain what is occurring to our building envelopes.

2. Obviously Everything Changes
Joe Lstiburek, Fellow ASHRAE*, Building Science Corp., Westford, MA*

When you change pressure relationships, change energy flows and change material properties you change everything. This is apparently not obvious. To make it all work you have to change design. This is apparently not obvious as well. Some of the changes necessary are minor, some are not. This should be obvious as well. This session is obviously about the obvious that is apparently not obvious.

3. Field Monitoring of Energy-Retrofitted Wall in a Cold Climate: Impact of the Vapor Permeance of Exterior Retrofit Insulation on the Flow of Moisture in a Wood Frame Wall
Wahid Maref*, National Research Council Canada, Ontario, ON, Canada*

Residential retrofit strategies can have an impact on the energy performance and durability of exterior walls. This research compares the retrofit strategy of installing a low-permeance insulation board with another strategy using high-permeance insulation. The measured hygrothermal response of the test specimens are compared at critical locations within the test assembly, over the Fall, Winter and Spring 2008, and compared to a reference specimen. This research is one of a series of projects that highlight direct and indirect impacts of hygrothermal performance of the building Envelope technologies in houses.

4. Energy-Efficient Envelope Design vs. Moisture Problems
Ray Patenaude, P.E., Member*, The Holmes Agency, Tierra Verde, Florida*

Reducing energy consumption with building envelopes can create moisture problems if not coordinated with the mechanical design. This presentation will reveal the real-life problems associated with building envelope design, mechanical systems and moisture problems in existing buildings. Emphasis is given to providing guidance for preventing problems that result when the mechanical design, especially VAV, is not coordinated with the building envelope which overworks the mechanical equipment and creates moisture problems.

Wednesday, June 30, 2010, 8:00 AM-9:30 AM

Seminar 49 (Intermediate)

Successful Ventilation and IAQ with Variable Refrigerant Flow

Track: High Efficiency HVAC Systems
Room: Dona Ana
Sponsor: TG8.VRF Variable Refrigerant Flow
Chair: Norm Maxwell, P.E., Member, Environmental Air Quality, Great Neck, NY

The use of variable refrigerant flow has been around for many years. The system is widely used in Europe and Asia but is not as common in the US. The system is being used at ASHRAE Headquarters. This seminar discusses ventilation and indoor air quality concerns.

1. 100% Outside Air with VRF
Paul L. Doppel*, Mitsubishi Electric, Suwanee, GA*

Ventilation air is difficult enough and using a VRF system may seem even more difficult. It is not only possible with VRF but bringing 100% ourside air can be accomplished with the bonus of energy free reheat. VRF system capabilities with heat recovery will be detailed to show how to bring about better IAQ with less operating cost.

2. Ventilation and IAQ Can Be Addressed with VRF
Chris Bellshaw, Member*, Daikin, Carrollton, TX*

As the North American VRF market continues to grow a common question is "How do you address outside air and indoor air quality"? This presentation will discuss ways to address and ways that do not address the issues in standard and dedicated VBRF indoor units.

3. Heat Pump Desiccant Unit and Dehumidfication with VRF
Yunho Hwang, Ph.D., Member*, University of Maryland, College Park, MD*

The variable refrigerant volume (VRV) air conditioning system needs to be operated in conjunction with a ventilation system. The common ventilation used with VRF system is a heat recovery unit. A self-regenerating heat pump desiccant (HPD) unit was used and its characteristics were investigated over a range of operating conditions in a field tests. The HPD unit maintained the target indoor humidity ratio of 10 g/kg throughout the cooling season resulting in better indoor thermal conditions than the HRV unit. The outdoor unit of the VRF system consumed 26.3% less energy using HPD unit than the HRV unit.

Wednesday, June 30, 2010, 8:00 AM-9:30 AM

Seminar 50 (Intermediate)

Sustainable Opportunities for Justice Facilities

Track: Living with HVAC&R Systems
Room: Ruidoso
Sponsor: 09.08 Large Building Air-Conditioning Applications, TG9.JF Justice Facilities
Chair: Richard Vehlow, P.E., Member, New York State Office of General Services, Albany, NY

This program discusses sustainable opportunities for justice facilities. The needed aim of sustainable design is to produce places, products and services in a way that reduces use of non-nm2010able resources, minimizes environmental impact, and relates people with the natural environment. Sustainable technologies are technologies which use less energy, fewer limited resources, do not deplete natural resources, do not directly or indirectly pollute the environment, and can be reused or recycled at the end of their useful life. In the energy sector sustainable is based on utilizing nm2010able sources of energy such as solar, wind, hydro, bioenergy, geothermal and hydrogen.

1. Sustainable Opportunities in Jails and Prisons
***Scott McMillan, P.E., Member**, HDR, Dallas, TX*

Movement towards sustainability has become popular in industry and considered good practice by ASHRAE. Applying LEED principles has been more difficult in some environments and building types, jails and prisons were among those considered more difficult. As heavy consumers of energy and water, this seminar will focus on ways to "green" jails and prisons that are looking to conserve resources and seek LEED certification.

2. Optimization of Energy Targets in Courthouses
***Boggarm Setty, P.E., Fellow ASHRAE**, Setty and Associates, Fairfax, VA*

Paper presents optimization of energy consumption in buildings, beginning with conceptual stages up to construction document completion. Presentation also includes issues involved in reaching the projected energy consumption during construction and post construction. Optimization process includes orientation of the building's zoning, system selection to satisfy the needs of that particular zone; operational hours of various areas based on its function, which includes courtrooms, security areas, prisoner holding cells, data room and administrative areas.

3. Energy Efficient Design of a County Correctional Facility
***Robert Cox, P.E., Member**, Jacobs Global Buildings, Cary, NC*

This presentation focuses on strategies to design correctional facilities to use up to 35% less energy through use of a variety of energy conservation strategies including VAV operation, OA Heat Recovery, and various control strategies including setback of delivery temperatures and use of dedicated outdoor air systems. The results are based on a case study of a retrofit of a County Correctional Facility which achieved the predicted energy conservation targets.

Wednesday, June 30
9:45 A.M.-10:45 A.M.

Wednesday, June 30, 2010, 9:45 AM-10:45 AM

Technical Paper Session 9 (Advanced)

Heat Gain from VFDs and Electrical Equipment

Track: Energy Facts vs. Simulation
Room: Galisteo
Sponsor: 09.02 Industrial Air Conditioning, 09.08 Large Building Air-Conditioning Applications
Chair: Deep Ghosh, Southern Co., Atlanta, GA

The objectives of this session are to provide information on heat loss for solid state VFDs at both full and part-loads and to show how these losses could be predicted. In developing these predictions, use is made of manufacturer and independently measured data. Two analytical part-load VFD power loss models are presented, a linear model in which the VFD power losses vary linearly with the load and a quadratic model in which the VFD power losses vary as the square of the load. The performance of these two analytical models is compared with measured part-load VFD power loss data. An example of VFD power loss at part-load is presented and compared with the results of the two models. The performance of the VFD power loss quadratic model is shown to be superior to the linear model.

1. Heat Gain From Adjustable Speed (Variable Frequency) Drives-RP 1395 (AB-010-024)
***E.C. Piesciorovsky** and Warren White, Ph.D., Member, Kansas State University, Manhattan, KS*

Abstract: The objectives of this paper are to provide information on heat loss for solid state VFDs at both full and part-loads and to show how these losses could be predicted. In developing these predictions, use is made of manufacturer and independently measured data. Two analytical part-load VFD power loss models are presented, a linear model in which the VFD power losses vary linearly with the load and a quadratic model in which the VFD power losses vary as the square of the load. The performance of these two analytical models is compared with measured part-load VFD power loss data.

2. Heat Gain from Electrical and Control Equipment in Industrial Plants, Part 2 (RP-1395) (AB-10-025)
***Warren White, Ph.D., Member** and E.C. Piesciorovsky, Kansas State University, Manhattan, KS*

Abstract: RP – 1395 is a continuation of an earlier project where the heat dissipated by indoor power distribution equipment is estimated. In RP – 1104 certain equipment were examined while others were not. The goals of RP – 1395 was to provide verification of some of the information presented in RP – 1104 and to investigate other types of equipment not previously covered. The scope of RP – 1395 is presented and the project results are summarized. Certain RP – 1395 equipment items are not presented here because these devices have been adequately treated in recent publications.

Wednesday, June 30, 2010, 9:45 AM-10:45 AM

Technical Paper Session 10 (Advanced)

GHG Calculations and Profiling Energy Use in Buildings

Track: Energy Facts vs. Simulation
Room: Ruidoso
Chair: Julia Keen, Kansas State University, Manhattan, KS

1. Profiling and Forecasting Daily Energy Use with Monthly Utility-Data Regression Models (AB-10-026)
Kevin Carpenter, Associate Member[1]*, Kelly Kissock, Ph.D., P.E., Member*[2]*, John Seryak, P.E., Associate Member*[3] *and Satyen Moray*[4]*, (1)CLEAResult Consulting, Inc., El Paso, TX, (2)University of Dayton, Dayton, OH, (3)Go Sustainable Energy, Columbus, OH, (4)ERS, Inc., Haverhill, MA*

Robust statistical regression models of commercial and industrial building energy use can be created as a function of outdoor air temperature, occupancy, production and/or other independent variables. These regression models have many uses, including forecasting energy use, benchmarking, identifying savings opportunities, and measuring energy savings from a normalized baseline. When evaluating facilities with this method, monthly utility bills are commonly used as source data because of their widespread availability and accuracy. Monthly energy data, however, provides less resolution than higher frequency daily or even hourly data.

2. Moving Toward Better GHG Calculations for Buildings (AB-10-027)
Michael Deru, Ph.D., Member*, National Renewable Energy Laboratory, Golden, CO*

Abstract: Buildings are responsible for approximately 40% of the primary energy use and 36% of greenhouse gas (GHG) emissions in the U.S. As we move toward reducing GHG emissions, we need reliable methods for estimating the emissions and the reductions in emissions. GHG emissions come from all life-cycle stages of a building; however, this paper is primarily concerned with the emissions associated with energy used in the building. There are many data sources and tools available for calculating the GHG emissions from building activies, but they have different assumptions, different data sources, and different system boundaries.

Wednesday, June 30, 2010, 9:45 AM-10:45 AM

Seminar 51 (Intermediate)

Electrical Safety and Regulatory Requirements and Application for Positive Displacement Compressors

Track: Refrigeration for the Future
Room: Mesilla
Sponsor: 08.01 Positive Displacement Compressors
Chair: Bob Utter, Member, Innovative Thermal Solutions, Adrian, MI

An overview of safety and regulatory requirements for the application of positive displacement refrigerant compressors in air-conditioning and refrigerating systems is presented. An overview of the applicability of the National Electric Code including information on how these national codes affect equipment design and selection is given. Additionally, specific information regarding the application requirements for hermetic refrigerant motor-compressor protection is presented.

1. Importance of the National Electrical Code to the Air-Conditioning and Refrigerating Industry
R. L. Bunch, Member*, RL Bunch Enterprises, LLC, Tecumseh, MI*

An overview of regulatory and safety requirements for the application of positive displacement refrigerant compressors is presented. An overview of the applicability of the National Electric Code is presented including information on how these national codes affect equipment design and selection. Additionally, specific information regarding the application requirements for hermetic refrigerant motor-compressor protection is presented.

2. Compressor Overload Protector Testing for Agency Recognition
John Tolbert*, Bristol Compressors, Bristol, VA*

Manufacturers of hermetic refrigerant motor-compressors are required to pass specific motor overload tests based on established standards. These criteria were developed in concert with industry and regulatory agency experts to assure a consistent level of product integrity and safety. This presentation covers the testing requirements and acceptance criteria with a focus on internal line break motor overload protection systems.

Wednesday, June 30, 2010, 9:45 AM-10:45 AM

Seminar 52 (Basic)

High Efficiency Energy Recovery for Healthcare and Laboratories

Track: High Efficiency HVAC Systems
Room: Brazos
Sponsor: 05.05 Air-to-Air Energy Recovery
Chair: Gregory Dobbs, Ph.D., Member , United Technologies Research Center, East Hartford, CT

Air-to-air energy recovery on ventilation air is enjoying increasing acceptance for many kinds of high-performance buildings. This session concentrates on the healthcare/laboratory area where occupancy is continuous and cross contamination not permissible. Technologies are introduced (e.g., twin towers, runaround loops) that meet the special needs of this high energy intensity application area. The sensible/latent heat requirements for the hot and dry climate area are discussed.

1. Case Study: Increased Energy Efficiency in the Operation of Health Care Facility (Hospital) through the Use of Twin Tower Air to Air Enthalpy Recovery System
Stan Slabinski*, Kathabar Dehumidification Systems Div., Niagara Blower Co., Somerset, NJ*

Healthcare facilities require long operating hours and no exhaust recirculation. Tight control is needed for both temperature and humidity. Energy recovery can help reduce this high cost if cross contamination is avoided. The twin tower liquid desiccant approach provides total enthalpy recovery (sensible and latent) heat recovery from remote make up and exhaust air streams with out the chance of cross contamination, with 90% plus bacteria removal from both air streams and greater than 60% total heat recovery. A hospital case study will be presented.

2. Runaround Loops for Healthcare and Laboratories
Ronnie Moffitt, P.E., Member*, Trane, Inc., Lexington, KY*

Hospital and Laboratories require a significant amount of outside air. The exhaust air often has contaminants which require it to be far removed from the ventilation air path making energy recovery difficult. Coil recovery loops can be utilized to recovery some of this exhaust energy back to the ventilation air. This seminar will look how efficient coils can be used to recover energy.

Wednesday, June 30, 2010, 9:45 AM-10:45 AM

Seminar 53 (Basic)

Introducing the 2010 Refrigeration Handbook, now with CO2!

Track: Refrigeration for the Future
Room: Aztec
Sponsor: Handbook Committee
Chair: Daniel Dettmers, Member, IRC, U.W. Madison, Madison, WI

The 4 year cycle is complete and the new 2010 Refrigeration Handbook has been delivered. Come see highlights of the major changes, including a new chapter dedicated to the use of Carbon Dioxide as a refrigerant.

1. Introducing the 2010 Refrigeration Handbook
***Mark Owen, Member**, ASHRAE, Atlanta, GA*

The ASHRAE Handbook editor will present an introduction to the new Refrigeration Handbook and the various formats in which it is available.

2. Introducing the New CO2 Chapter
***John Topliss, Member**, Refrigeration Components (RCC) Canada Ltd., Delta, BC, Canada*

This presentation will introduce the newly created Carbon Dioxide chapter for the 2010 Refrigeration Handbook.

3. Other Exciting Additions and Updates to the 2010 Handbook
***Daniel Dettmers, Member**, IRC, U.W. Madison, Madison, WI*

This presentation will highlight the changes and updates to 2010 Refrigeration Handbook.

Wednesday, June 30, 2010, 9:45 AM-10:45 AM

Seminar 54 (Intermediate)

Ratings vs. Actual Performance in Refrigeration

Track: Refrigeration for the Future
Room: San Miguel
Sponsor: 10.01 Custom Engineered Refrigeration Systems
Chair: Douglas Reindl, Ph.D., P.E., Member, IRC, University of Wisconsin-Madison, Madison, WI

This session explores the difference between the performance of refrigeration equipment as rated in equipment catalogs versus their performance under actual conditions. Due to the lack of industry standard rating conditions, refrigeration manufacturers typically publish capacity ratings based on a specific set of conditions that may or may not relate to the conditions the equipment will be operated at. Likewise, refrigeration equipment is often used in industrial environments that can quickly degrade equipment performance due to the harsh and dirty environment.

1. Ratings vs. Actual Application: Commercial Walk-in Refrigeration Systems
***Cassie Cuaresma, Associate Member**, Vacom Technologies, La Verne, CA*

Current rating conditions for walk-in freezers can be a bit misleading. Compressor ratings assume a return gas temperature (RGT) of 65F. Of course, the actual RGT is normally lower than 65 F which can lead to lead to as much as 30% discrepancy between “catalog” and actual realized capacity. This presentation will provide results of an analysis of standard rating basis for compressors vs. actual operating conditions, including impact on productive refrigeration, superheat effects, implications for future performance standards and energy efficiency.

2. Effects of Fouling and Contaminants on Refrigeration Evaporator Performance
***Bruce Nelson, P.E., Member**, Colmac Coil Manufacturing, Inc., Colville, WA*

Refrigeration evaporator manufacturers typically publish capacity ratings based on clean internal and external surfaces free of fouling and/or contaminants in the refrigerant. Fouling of evaporator fins by airborne dirt, dust, oils, etc., lowers the overall heat transfer coefficient and hence cooling capacity. Evaporators operating with fin surface temperatures below 32F (0C) will accumulate frost which acts as an additional resistance to heat transfer. The presentation will examine and quantify the effect of each type of fouling and contamination mentioned above on rated evaporator performance.

3. External Factors on Evaporative Condenser Performance
***Daryn S. Cline, Member**, EVAPCO, Inc., Taneytown, MD*

This presentation will look at how external factors, such as scaling, influence the capacity and performance of evaporative condensers.

Wednesday, June 30, 2010, 9:45 AM-10:45 AM

Forum 9 (Advanced)

HVAC&R Research: Buildings and Energy

Track: Energy Facts vs. Simulation
Room: Cimarron
Sponsor: HVAC&R Research Journal
Chair: Jelena Srebric, Ph.D., Member, The Pennsylvania State University, University Park, PA

This is the first forum in a series organized by the HVAC&R Research journal, and the forum topic is related to past and present experiences with energy research for buildings. The goal is to enable discussions to uncover the main barriers in applied and fundamental research for the advancement of HVAC&R technology. The experiences from the first energy crises informed the HVAC&R technological revolution in the end of 20th century. The question is how we can draw on those and other current experiences to stimulate the technological revolution in the beginning of the 21st century.

Wednesday, June 30, 2010, 9:45 AM-10:45 AM

Forum 10 (Intermediate)

The Human Element: Difficulties in Analyzing and Simulating Occupant Behavior and the Resulting Impacts on Energy Modeling

Track: Energy Facts vs. Simulation
Room: Dona Ana
Sponsor: 04.04 Building Materials and Building Envelope Performance, 04.07 Energy Calculations
Chair: Joe Huang, P.E., White Box Technologies, Moraga, CA

Occupant-based loads, including lighting, demand-based ventilation, and plug loads can have a significant impact on building energy use. Despite the relative accuracy of some energy modeling programs, the results are often at the mercy of the occupants, whose future actions can lead to actual energy use in excess of that predicted through computer simulation. This forum provides discussion of the various loads that affect buildings, including primary and secondary contributors, as well as methods of accounting for those loads in the most accurate way possible to reduce the discrepancies between actual and predicted energy use in buildings.

Wednesday, June 30
11:00 A.M.-12:30 P.M.

Wednesday, June 30, 2010, 11:00 AM-12:30 PM

Seminar 55 (Intermediate)

Campus Master Planning for Energy Conservation and Sustainability

Track: Living with HVAC&R Systems
Room: San Miguel
Sponsor: 09.07 Educational Facilities, 09.06 Health Care Facilities, 07.06 Systems Energy, 06.02 District Energy
Chair: Filza H. Walters, Member, Lawrence Technological University, Southfield, MI

This seminar addresses how energy management, energy conservation, alternative energy production and distribution are essential elements of a sustainable master plan for large, district and campus facilities. Case studies involving multi-building campuses including educational, healthcare, commercial and industrial buildings are highlighted to demonstrate challenges and opportunities for operational savings. Each phase of a sustainable initiative including planning, design, construction, operation, execution, implementation and maintenance activities is discussed relative to anticipated, desired and actual results.

1. Master Planning for Energy Conservation on Medical University Campuses
Ronald L. Westbrook, P.E., Member*, State University of New York, Upstate Medical University, Syracuse, NY*

Expansion of health care and health sciences research on university campuses has led to numerous new construction and renovation projects. After a decade of uncontrolled growth, the State University New York Upstate Medical University campus, like many other campuses around the country, found themselves with out-of-control energy costs, utility distribution problems, and other issues detrimental to the Campus' role as a responsible steward of the community. With leadership from the State Governor, the campus began developing master plans for sustainable growth and operation. This program details the critical components of the program and the coordination efforts entailed in developing it.

2. Hands-On Energy Management Shows Quick Payback: A Case Study for Multiple Building Operations
Richard J. Pearson, Fellow ASHRAE*, Pearson Engineering, Madison, WI*

This successful case history involves multiple hospitals using a unique method to model daily, energy consumption, with examples of onsite interaction with the building staff to “beat the model” and to exceed expectations. This program follows the ENERGY STAR “Guidelines for Energy Management,” from “Assess Performance” through “Evaluate Progress.” Using the model, which is normalized for weather, positive, daily feedback encourages the staff to continue to optimize building performance. The case histories illustrate first year energy reductions exceeding 6%, with no capital expenditures and estimated at well beyond $1.6 million in operational savings for a campus of over 7,000,000 sf.

3. What Building Owners and Designers Need to Consider for Master Planning and Budgeting for Multiple Building Sites
Lucas Hyman, P.E., Member*, Goss Engineering, Corona, CA*

This seminar will outline the key steps necessary for a campus utility master plan including understanding existing systems and operations, determining existing loads, estimating future loads, developing technically feasible options, and the importance of a high delta-T. Site issues, establishing utility corridors, estimating energy useage, associated costs and methods for estimating budget project costs is included. Conducting life-cycle cost analysis and making recommendations to key stakeholders and building owners is demonstrated through a case study.

4. The Role of Utilities in Master Planning Efforts for Greening Campus Environments
David Handwork, P.E., Member*, Arkansas State University, Jonesboro, AR*

How can a team develop a conceptual design for implementation, improvement and expansion of an existing district cooling system at a major University located in the South with a hot and humid climate? Two separate district cooling loops were installed to serve a total connected load of 5,000 tons utilizing existing building chiller plants, while attempting to achieve energy efficiency. Planning and design efforts included considerations for additional new buildings, and incorporated energy conserving equipment. The preliminary cost of the recommended new system and its components, expected to be in excess of 2.8 million dollars, will be discussed.

Wednesday, June 30, 2010, 11:00 AM-12:30 PM

Seminar 56 (Intermediate)

Demystifying Active Chilled Beams

Track: High Efficiency HVAC Systems
Room: Brazos
Sponsor: 05.03 Room Air Distribution
Chair: Fred S. Bauman, P.E., Member, Center for the Built Environment (CBE), University of California, Berkeley, Berkeley, CA

This seminar will briefly introduce the concept of active and passive chilled beams followed by a discussion of the following key design and operation issues focusing on applications of active chilled beams: Room air distribution and comfort considerations; Controls for chilled beam systems; Design considerations for all climates; Energy performance of chilled beam systems; Acoustical and system pressure loss considerations; Central equipment design; and Case studies.

1. Designing Active Chilled Beam Systems for Occupant Thermal Comfort
***Kenneth J. Loudermilk, P.E., Member**, TROX USA, Cumming, GA*

This presentation will review the basic operational concepts of active chilled beams and discuss their application with respect to maintenance of occupant thermal comfort. The presentation will focus on the selection and location of beams in order to provide acceptable levels of occupant comfort as outlined in ASHRAE Standard 55 and ASHRAE Standard 62.1.

2. Controlling and Operating Active Chilled Beam Systems
***Peter Simmonds, Ph.D., P.E., Fellow ASHRAE**, IBE Consulting Engineers, Sherman Oaks, CA*

Active beams can provide comfort conditions consuming less energy than conventional systems if they are controlled and operated correctly. Not only correct temperature control, but also the required ventilation air, all this without the vaguest possibility of condensation.

3. Design Considerations and Case Studies
***Vladimir Petrovic, Ph.D., P.E., Member**, DADANCO LLC, Westfield, MA*

Applying fundamentals of psychrometrics is essential in successful design of active chilled beam systems, in any climate. Particular attention is being given to implications on efficiency of the system with respect to a choice of room design conditions. Case study results will also be presented.

Wednesday, June 30, 2010, 11:00 AM-12:30 PM

Seminar 57 (Intermediate)

Designing and Building A Large Scale Net-Zero Energy Building

Track: Energy Conservation vs. New Generation
Room: Mesilla
Sponsor: 07.01 Integrated Building Design, 02.08 Building Environmental Impacts and Sustainability
Chair: Shanti Pless, Member, National Renewable Energy Laboratory, Golden, CO

The Department of Energy's National Renewable Energy Laboratory moves into its new 219,000 SF Research Support Facilities (RSF) in June of 2010. The RSF, which is pursuing LEED-NC Platinum certification, will be the largest completed office building designed to meet net zero energy in North America. Hear from a panel made up of the owner and design build team and learn from their perspectives on delivering the first large scale replicable net zero energy office building. Attendees gain insight on the process, methods, best practices and strategies used to successfully deliver and operate a net zero energy building.

1. Living and Procuring a Net Zero Energy Building: The Owner's Perspective
***Paul Torcellini, Ph.D., Member**, National Renewable Energy Laboratory, Golden, CO*

Hear from the owner on the delivery of this next generation zero energy building. The process started with an innovative procurement method by the Department of Energy. The project's RFP stipulated LEED Platinum as a contractual requirement and set an energy use energy target for the building of 25 kBtu/SF/year. The RFP also included stretch goals such as a net zero energy approach and to deliver the most energy efficient building in the world. This procurement and delivery method proved to be a significant departure from standard practice.

2. Energy Modeling and Mechanical Design for a Net-Zero Energy Building
***David Okada, P.E., Member**, Stantec, San Francisco, CA*

This presentation addresses the importance of energy efficiency and passive systems in reaching a net zero energy position. Passive and low energy strategies utilized include daylighting, solar shading, operable windows/natural ventilation, thermal mass, night purging, thermal labyrinth, transpired solar collector, high performance envelope, radiant cooling and heating, and underfloor ventilation air. In addition, plug loads are managed and addressed along with implementation of low energy data center strategies. The open interior design with low workstation heights was critical in meeting the energy goals by optimizing the use of daylighting, natural ventilation and the radiant ceiling system.

3. Designing and Building a Net-Zero Energy Building: The Builder's Perspective
***Brian Livingston**, Haselden Construction, Commerce City, CO*

The unique delivery method for the project is presented. The project was design build, which favored the intense integrated design approach required to meet the aggressive cost and energy goals. This procurement and delivery method proved to be a significant departure from standard practice and resulted in innovative ways of sharing and managing risk between the owner and design build team.

Wednesday, June 30, 2010, 11:00 AM-12:30 PM

Seminar 58 (Basic)

Exergy and Comfort; Finding the Right Balance: Fundamentals

Track: Energy Conservation vs. New Generation
Room: Cimarron
Sponsor: TG1.Exergy Analysis for Sustainable Buildings
Chair: Tom Meyer, Member, Praxis Green Inc, Neenah, WI

Development of balanced comfort systems meeting sustainable building design goals requires considering the exergy processes within the human body and in buildings. The perception of thermal comfort seems to be associated with a relatively low exergy consumption rate within the human body. Balance between this exergy consumption, thermal comfort, and subjective thermal sensation seems elusive. This seminar speaks to the need for new indoor environment quality criteria by understanding the energy and exergy based perception and sensation of occupants. It focuses on coupled fundamentals and examples of exergy analysis of the thermoregulation of the human body and the building.

1. An Investigation on the Assessed Thermal Sensation and Human Body Exergy Consumption Rate
***Bjarne Olesen, Ph.D., Fellow ASHRAE**, Technical University of Denmark, Lyngby, Denmark*

The exergy contained by a system is the maximum available work that can be extracted from the energy contained by that system into its environment. As the building should provide healthy and comfortable environment for its occupants, it is reasonable to consider both the exergy flows in building and those within the human body. There is a need to verify the human-body exergy model with the thermal-sensation response of subjects exposed to different combinations of the indoor climate parameters (temperature, humidity, air velocity, etc.). The objective is to relate thermal sensation data to the calculated human-body exergy consumption rate.

2. Exergy Aspects of Operative Temperature and Its Importance on Energy and Comfort
***Birol Kilkis, Ph.D., Fellow ASHRAE**, Baskent University, Ankara, Turkey*

This study establishes a fundamental relationship among thermal comfort, exergetic comfort, energy, and exergy efficiency and introduces a new optimization algorithm. Results show that calculation of air exergy and radiant exergy is an important step to determine the optimum split of air temperature (dry-bulb)and

mean radiant temperature, while minimum human body exergy loss provides the most comprehensive condition for the operative temperature. Sample calculations based on Rational Exergy Management Model (REMM) show that substantial energy savings may be achieved with minimum carbon footprint while human exergy loss is optimized for better comfort during heating and cooling seasons.

3. What Comes First -- Green and Sustainability or Well-Being? A Balancing Act
Diotima von Kempski, Member*, DVK, Dusseldorf, Germany*

Many tools and concepts have been developed for energy savings. Most of them are efficient. But we lag the right tool for well-being of occupants. The question we should be asking is: what should have the priority? People vs. environment and/or energy saving vs. human costs?

Wednesday, June 30, 2010, 11:00 AM-12:30 PM

Seminar 59 (Intermediate)

Higher Efficiency in New and Existing Buildings

Track: High Efficiency HVAC Systems
Room: Aztec
Sponsor: 09.08 Large Building Air-Conditioning Applications
Chair: Jeff J. Traylor, Member, EMCOR Government Services, Arlington, VA

This seminar presents means and methods used to achieve higher energy efficiency in a laboratory, a college dormitory, and a historical government building.

1. Optimizing Energy Efficiency in a University Laboratory Facility
Robert Cox, P.E.*, Jacobs Carter Burgess, Cary, NC*

This presentation examines the results of retro-commissioning and implementation of energy conservation measures low flow fume hood retrofit design, modified control strategies and use of heat recovery chiller heat pumps to reduce the energy consumption of a large university research laboratory by 45%.

2. Energy Retrofit in a Historical Government Building
Steve Nicklas, P.E., Associate Member*, EMCOR Government Services, Arlington, VA*

This presentation will discuss the approach to improve efficiency of the domestic and HVAC water heating systems, while meeting the requirements for reliability in a historical, high security government building

Wednesday, June 30, 2010, 11:00 AM-12:30 PM

Seminar 60 (Intermediate)

Recent Advances in VAV Control Technology

Track: High Efficiency HVAC Systems
Room: Galisteo
Sponsor: 01.04 Control Theory and Application, 01.05 Computer Applications
Chair: Michael A. Pouchak, P.E., Honeywell, Golden Valley, MN

Variable air volume (VAV) air systems are a key component of modern medium to large building zone control. Most VAV systems have pressure independent terminals which use airflow control systems to operate zone dampers. Proper controls and system design will ensure that the building will be operated efficiently, resulting in strategies that maximize comfort and minimize energy usage. Recent advances in VAV controls such as additional control strategies and improvements in low air flow measurement will enhance VAV control performance for current best practice design.

1. Stability and Accuracy of VAV Boxes at Low Flow
Jin Wen, Member*, Drexel University, Philadelphia, PA*

Accurate VAV box control depends on the stability and accuracy of VAV box performance at low flows. This seminar will focus on the result of recent ASHRAE research that includes a survey of current VAV box technologies and a comparison of performance of the different technologies at low flow velocities. Effective minimum controllable flow setpoints are critical for energy efficient control of VAV boxes.

2. Advanced VAV System Control and Design
Jeff Stein, P.E., Member*, Taylor Engineering, Alameda, CA*

Variable Air Volume systems are an essential component for energy efficient control. Recent research into VAV box performance at low flows were used to develop new California and ASHRAE energy code requirements for VAV controls that are predicted to save about $0.05/sq. ft-yr across a wide cross-section of new and existing commercial buildings.

3. Flexible Control Strategies for VAV Systems
Levi Geadelmann, Member*, Honeywell International, Golden Valley, MN*

As modern controllers increase in power and flexibility, the opportunity to leverage proven embedded control strategies with new energy savings strategies and coordination of system control is now available. Libraries of standard control sequences and integration with Web-enabled Graphical displays will continue to enhance the value and energy savings of VAV control systems.

Wednesday, June 30, 2010, 11:00 AM-12:30 PM

Seminar 61 (Intermediate)

Refrigeration Systems Using Environmentally-Friendly Refrigerants

Track: Refrigeration for the Future
Room: Ruidoso
Sponsor: 08.05 Liquid-to-Refrigerant Heat Exchangers, 01.03 Heat Transfer and Fluid Flow
Chair: Yunho Hwang, Ph.D., Member, University of Maryland, College Park, MD

Environmentally benign refrigerants such as natural refrigerants and new ultra-low GWP refrigerants are gradually replacing conventional refrigerants in vapor compression cycles. These refrigerants provide ultra-low or no global warming potential with zero ozone depletion potential. System efficiencies are impacted by the thermo-physical properties of these refrigerants in several ways. This seminar presents new findings on the environmentally-friendly refrigerants, such as R744 (carbon dioxide), R717 (ammonia), and HFO-1234, used in refrigeration systems. This topic is critical to current and future ASHRAE research, and is along the 2010-2015 strategic plan with NR/GWP Theme.

1. Application of Enhanced Heat Transfer in Ammonia Spray Chillers
Zahid Ayub, Ph.D., P.E., Fellow ASHRAE*, Isotherm, Inc., Arlington, TX*

In the last decade a moderate headway has been made in the application of novel and compact heat exchangers with enhanced surface in ammonia refrigeration systems. This has been a result of the persistent issue of ozone and global warming which has resulted in keen interest in natural refrigerants such as ammonia that has played a prominent role in the refrigeration industry for years. This presentation provides an overview of the status of ammonia as a refrigerant and discusses the present and the future trends in the development of compact heat exchangers for use in ammonia refrigeration.

2. Performance and Thermal Evaluation of Low Global Warming Refrigerants for Stationary AC&R Applications
Mark Spatz, P.E., Member*, Honeywell Inc., Buffalo, NY*

As a result of the need to find a suitable substitute for R-134a for Auto AC application, a very low global warming refrigerant was identified, HFO-1234yf. In addition to the phase out for auto applications, R-134a has recently been phased-out in the EU as a blowing agent for one-component foam applications. For this application, another HFO is being used, HFO-1234ze, an isomer of HFO-1234yf. This presentation will present and discuss experimental evaluations of these two HFO molecules and some blends, focusing on their thermal behavior inside HVAC systems.

3. Condensation of CO2 as a Low GWP Refrigerant in Brazed Plate Heat Exchangers

Amir Jokar, Ph.D., Member[1] *and Niel Hayes, Affiliate*[2]*, (1)ThermoFluids Tech, Vancouver, WA, (2)Browns Hill Engineering and Controls, LLC, Littleton, CO*

Global warming concerns are gaining momentum in the twenty-first century and as such, environmentally friendly refrigerants are quickly becoming a necessity rather than just an interesting topic to speculate about for the future. R-744 or carbon dioxide (CO2) is a top contender, as instigated in the Montreal protocol, to phase out the use of ozone depleting chlorofluorocarbon (CFC) and the greenhouse gas contributing hydrochlorofluorocarbon (HCFC) refrigerants, especially in low temperature applications. This presentation discuss on the recent experimental findings for the condensation of carbon dioxide in plate heat exchangers with the applications in HVAC&R.

Wednesday, June 30, 2010, 11:00 AM-12:30 PM

Seminar 62 (Intermediate)

Ventilation in Labs Under the New ANSI Z-9.5

Track: Ventilation Systems

Room: Dona Ana

Sponsor: 09.10 Laboratory Systems

Chair: J. Patrick Carpenter, P.E., Member, Facility Performance Engineers, Cinnaminson, NJ

Control of indoor contaminants in labs using ventilation systems to improve occupant safety and maximize indoor environmental quality requires integrated solutions. While many applicable codes and standards focus on ventilation as the key to health and safety, few consider energy use or sustainable objectives. One of the most referenced standards is ANSI Z-9.5 – Laboratory Ventilation. Current revisions to this standard reflect an increased sensitivity to avoiding over design of ventilation systems as the best means to minimize energy use and provide more sustainable solutions. This session reviews changes in latest version that impact opportunities for sustainable designs.

1. Overview of Changes to ANSI Z-9.5 - Ventilation System Design

Jim Coogan, Member*, Siemens Building Technologies, Buffalo Grove, IL*

Ventilation system designers often use the Laboratory Ventilation Standard from AIHA as a source of basic requirements. Changes with the recent revision of this standard include emergency ventilation issues, exhaust system design and classification and the objectives of space pressurization functions. Overall, the revision committee sought to make guidance more consistent with related codes and to promote a more uniform perception of ventilation issues among safety professionals, laboratory users, facility operators and designers.

2. New Requirements for Laboratory Ventilation Management in the ANSI/AIHA Z9.5

Thomas Smith, Member*, Exposure Control Technologies, Inc, Cary, NC*

ANSI/AIHA Z9.5 requires lab managers to develop a Laboratory Ventilation Management Program (LVMP). A LVMP must be developed to ensure proper selection, operation, use, and maintenance of laboratory ventilation equipment. The Z9.5 guideline provides information to help develop a comprehensive LVMP that will help ensure proper operation of the lab ventilation systems, help protect laboratory personnel working with potentially hazardous airborne materials, provide satisfactory environmental air quality and maintain efficient operation of the laboratory ventilation systems. This presentation will describe proposed guidelines and new requirements of the Z9.5 standard.

3. Changes to the ANSI Z9.5 Fume Hood Minimum Ventilation Rate

Gordon Sharp, Ph.D., P.E., Member*, Aircuity, Inc., Newton, MA*

One important change in ANSI Z9.5 Laboratory Ventilation deals with the minimum flow requirements for fume hoods. This has taken on increased importance since NFPA 45 has recently dropped its fume hood minimum flow rate language and refers to ANSI Z9.5. To better address energy usage often driven by minimum flows of VAV hoods, minimum flows are defined based more on hood volume than work surface. Recommendations will include a range of conditions. Presentation will also present research and industry data to provide support and guidance on setting an appropriately energy efficient, yet safe fume hood minimum flow value.