ASHRAE and IBPSA-USA SimBuild 2016: Building Performance Modeling Conference

August 10-12, 2016 · Salt Lake City, Utah

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Technical Program Book
August 23, 2016

Wednesday, August 10

Wednesday, August 10, 8:15 AM-9:00 AM

KEYNOTE

So Happy Together: Architects and Energy Modelers Informing Building Design

Room: Grand Ballroom

Chair: Dennis Knight, P.E., BEMP, Fellow ASHRAE, Whole Building Systems, LLC, Charleston, SC

Kjell Anderson, *AIA, LMN Architects, Seattle, WA*

    To meet Architecture 2030 goals, all project teams need to analyze passive and active design solutions from project outset, requiring a collaboration of energy modeling and architectural design efforts. While compliance modeling efforts are understood and widely performed, the early design process remains enigmatic to both modelers and architects. Architects ask 'how is this performing?' and want various geometries compared with immediate answers; modelers want detailed data and enough time to perform simulations. Architects often fail to understand the loads they create with geometry and glazing, and modelers don't often present their results clearly enough to get ideas across to architects and their clients. Architects, in many cases, never even meet the energy modeler on their project. We can drastically improve project performance by focusing on the relationship between architects and energy modelers: forging a better process as outlined in ASHRAE 209, understanding each other's language and constraints, learning to ask the right questions, and realizing the amazing things we can accomplish together.

Wednesday, August 10, 9:15 AM-10:45 AM

CONFERENCE PAPER SESSION 1 (INTERMEDIATE)

HVAC Component Modeling and Load Analysis l

Room: Canyon B

Chair: Susan Collins, Whole Building Systems, Charleston, SC

    Modern buildings continue to experience a changing landscape of thermal load distribution and HVAC technologies. Novel measures, decreased envelope losses, shifting plug loads, and other changing parameters can make selecting efficient and appropriate equipment challenging, but new techniques are being developed to keep pace. This session presents four emerging methodologies: a Bayesian Network to calculate cooling loads, a polynomial based model to determine cooling tower evaporation water loss, an empirical method to quantify plug loads and their daily variance, and a thermal model of a photonic radiative cooler and a simulation of its integration with radiant zone cooling in EnergyPlus.

1. A New Polynomial Based Model for Determining Cooling Tower Evaporation Water Loss
Aaron Powers, P.E., BEMP, Member, Johnson Controls, Inc., Memphis, TN

2. Simulating Empirically-Determined Plug Loads to Improve Knowledge of Design Loads and Assess Building Performance Improvement Opportunities
Justin Lueker[1], Annie Marston, Ph.D., BEMP[1], Oliver Baumann, CPMP, Member[1] and Raghuram Sunnam[1], (1)Baumann Consulting, Inc., Washington, DC

3. Modeling and Simulation of a Photonic Radiative Cooling System
*Weimin Wang, Ph.D., Member[1], **Nick Fernandez**[1] and Srinivas Katipamula, Ph.D., Fellow ASHRAE[1], (1)Pacific Northwest National Laboratory, Richland, WA*

4. A Bayesian Network Model for Predicting Cooling Loads
***Wangda Zuo, Ph.D., Member**[1], Sen Huang, Student Member[1] and Michael Sohn, Ph.D.[2], (1)University of Miami, Coral Gables, FL, (2)Lawrence Berkeley National Laboratory, Berkeley, CA*

CONFERENCE PAPER SESSION 2 (BASIC)

Lighting and Daylighting

Room: Canyon A

Chair: Elizabeth Gillmor, P.E., BEMP, Member, Energetics Consulting Engineers, LLC, Aurora, CO

Novel models and increased interoperability have advanced daylight modeling, but several barriers still remain. These tools can be computationally expensive; energy benefits must be shown to outweigh the investment; a lack of consensus regarding simulated behavioral patterns remains; and passive solar design is often at odds with daylighting goals. This session presents a toolkit for leveraging the OpenStudio platform to perform scripted daylighting analysis and optimization, the Advanced Lighting Controls Systems (ALCS), which provides easy access to customized calculation of lighting control energy saving, human factors daylighting field research, and a retrofit which balances passive thermal and daylighting goals.

1. Sensitivity Study of Annual and Point in Time Daylight Performance Metrics: A Twenty-Four Space Multi-Year Field Study
Amir Nezamdoost[1] and Kevin Van Den Wymelenberg, Ph.D.[2], (1)Integrated Design Lab, University of Idaho, Boise, ID, (2)Energy Studies in Buildings Laboratory, University of Oregon, Eugene, OR

2. Applicability of DGP and DGI For Evaluating Glare in a Brightly Daylit Space
Andrew McNeil[1] and Galen Burrell[2], (1)Freelance daylight specialist, Oakland, CA, (2)Arup, San Francisco, CA

3. A Framework for Daylighting Optimization in Whole Buildings with OpenStudio
Rob Guglielmetti[1] and Brian Ball, Ph.D.[1], (1)National Renewable Energy Laboratory, Golden, CO

4. Calculation Methodology for the Advanced Lighting Control Systems (ALCS) Energy Savings Calculator Tool
Mudit Saxena, Member[1], David Alexander, P.E., Member[2] and Gabe Arnold, P.E., Member[3], (1)Vistar Energy Consulting, Rocklin, CA, (2)Pacific Gas and Electric Company, San Francisco, CA, (3)Northeast Energy Efficiency Partnerships, Lexington, MA

SEMINAR 1 (INTERMEDIATE)

BIM to BEM

Room: Alpine West

Chair: Luke Troup, Student Member, Northeastern University, Boston, MA

Successful integration of a BIM project with energy modeling is a valuable asset that requires high quality data exchange file formats to ensure compatibility and interoperability with external analysis applications. This session provides the BIM modeler best practices for energy modeling uses, starting with the baseline model development and schematic design, through to more complex federated BIM projects.

1. Preparing Your BIM Model for the Best Energy Analysis Results
David Butts, Gannett Fleming, Raleigh, NC

2. Interoperate Between BIM and BEM: Exchange Building Design Information and Simulated Data within a Common Data Environment to Promote Collaboration Between Disciplines
Jean Carriere, Associate Member, IES, Ottawa, ON, Canada

3. IBPSA Project "BIM/GIS and Modelica Framework for Building and Community Energy System Design and Operation"
Michael Wetter, Ph.D., Member[1] and Christoph van Treeck, Ph.D.[2], (1)Lawrence Berkeley Lab, Berkeley, CA, (2)RWTH Aachen University, Aachen, Germany

SEMINAR 2 (INTERMEDIATE)

Simulation Techniques I

Room: Alpine East

Chair: Rahul Athalye, Associate Member, Pacific Northwest National Laboratory, Richland, WA

Building simulation is ever advancing to cover improved inputs and measures, while aiming to reach a wider audience. This session quantifies a new methodology's improved thermostat impact assessment, which is not typically understood because the models assume a well-mixed indoor environment; describes a web application that leverages the OpenStudio APIs, allowing users with limited modeling expertise to economically create a large number of models; and compares international typical meteorological data sets with the actual period of record that they represent to show that the climatic response of the building would be better served by a range of building climatic data.

1. Streamlining Building Energy Model Generation
Alex M Bennett[1], David Pudleiner[1], Alec Danaher, P.E.[1] and Haider Khan[2], (1)ICF International, Fairfax, VA, (2)ICF International, Toronto, ON, Canada

2. Rethinking Climate and Weather Data for Building Simulation
Drury Crawley, Ph.D., BEMP, Fellow ASHRAE[1] and Linda Lawrie, Member[2], (1)Bentley Systems, Inc., Washington, DC, (2)DHL Consulting LLC, Pagosa Springs, CO

3. How to Include the Impact of Thermostat into Building Load Calculation
Yao Yu, Ph.D., BEMP and BEAP, Associate Member, North Dakota State University, Fargo, ND

Wednesday, August 10, 11:15 AM-12:15 PM

CONFERENCE PAPER SESSION 3 (INTERMEDIATE)

Computational Fluid Dynamics

Room: Canyon B

Chair: Yu Joe Huang, BEMP, White Box Technologies, Moraga, CA

Efficient natural ventilation can provide high indoor air quality, good thermal comfort, and low energy consumption. However, when modeling these complex systems, simulation accuracy continues to be at odds with computing speed. This session first describes the computational efficiency of an in situ adaptive tabulation – fast fluid dynamics (ISAT-FFD) simulation. This session also covers a Shear Stress Transport (SST) k-w turbulent methodology that accounts for the complex and highly related interaction of outdoor and indoor airflow and the resulting Carbon Monoxide (CO) pollution transport through building openings.

1. Fast Indoor Airflow Simulation Using in Situ Adaptive Tabulation and Fast Fluid Dynamics
*Dan Li[1], Wei Tian, Student Member[2], **Wangda Zuo, Ph.D., Member[3]** and Michael Wetter, Ph.D., Member[4], (1)University of Miami, Miami, FL, (2)University of Miami, Miami, FL, (3)University of Miami, Coral Gables, FL, (4)Lawrence Berkeley Lab, Berkeley, CA*

2. Pollution Transport through Openings Based on Coupled Indoor and Outdoor Interactions
Chao Ding[1] and Khee Poh Lam, Ph.D.[1], (1)Carnegie Mellon University, Pittsburgh, PA

CONFERENCE PAPER SESSION 4 (INTERMEDIATE)

Energy Auditing

Room: Canyon A

Chair: Yung Nguyen, DNV GL, San Diego, CA

This session describes baseline model methodologies to improve accuracy, reduce speed, and expand building types. Numerous methods have been implemented in the commercial and residential sectors, while only limited change-point regression models have been analyzed in the industrial sector. The first presentation explores the relative effectiveness of Gaussian process regression (GPR) to change-point regression in baseline industrial energy models. The next talk describes the Smart Energy Analysis Calculator (SEAC), an automated online tool that utilizes input data collected by Rapid Building Energy Modeler (RAPMOD) technology to identify energy conservation measures and their associated energy and cost savings in existing buildings.

1. Smart Energy Analysis Calculator: An Interactive Tool for Automation Building Energy Analysis and Expediting Energy Audits
Annie Marston, Ph.D., BEMP[1], Claudio Tschaetsch[1], Eric Turner, Ph.D.[2], Avideh Zakhor, Ph.D.[2], Jonathan Lemmond, P.E.[1] and Oliver Baumann, CPMP, Member[1], (1)Baumann Consulting, Inc., Washington, DC, (2)Indoor Reality, California, CA

2. A Comparison of Gaussian Process Regression and Change-Point Regression for the Baseline Model in Industrial Facilities
Joseph Carpenter[1], Keith Woodbury, Ph.D., P.E.[1] and Zheng O`Neill, Ph.D., P.E., Member[1], (1)University of Alabama, Tuscaloosa, AL

SEMINAR 3 (INTERMEDIATE)

Code Compliance

Room: Alpine East

Chair: Rahul Athalye, Associate Member, Pacific Northwest National Laboratory, Richland, WA

As building codes become more stringent, and in general move toward zero or very low-energy goals, advances in code compliance software (and BEM in general) will need to keep pace. This session explores ways to improve consistency in the availability and capability of measures between tools, lessen the gap in functionality between EnergyPlus and compliance software, and explore a shared public vision to guide long-term advancements in BEM.

1. Comparing the Performance of RESNET Certified Software Programs for Energy Code Compliance in Texas
Jaya Mukhopadhyay, Ph.D., Member[1], Juan-Carlos Baltazar, Ph.D., P.E., BEMP, Member[2] and Jeff S. Haberl, Ph.D., BEMP, Fellow ASHRAE[2], (1)Montana State University, Bozeman, MT, (2)Texas A&M University, College Station, TX

2. Closing the Simulation Gap Between Zero Energy Buildings and Code Compliance
Bach Tsan, P.E.[1] and Andres Fergadiotti, P.E.[1], (1)Southern California Edison, Rosemead, CA

3. Taming the Beast (Building Energy Analysis and Simulation Tools): A Public Vision for Leveraging Simulation to Accomplish Statewide Goals
Will Vicent[1] and Bach Tsan, P.E.[2], (1)Between Built & Natural Environments, Rancho Santa Margarita, CA, (2)Southern California Edison, Rosemead, CA

SEMINAR 4 (INTERMEDIATE)

Data Mining and Parametric Analysis

Room: Alpine West

Chair: Ahoo Malekafzali Ardakan, Ph.D., North Carolina State University, Raleigh, NC

Because actual performance is what counts, it is important to easily detect and fix anomalies in building operations. Research into techniques for doing this are reviewed. Energy models often use one input to calculate infiltration without taking into account complicating factors such as multiple zones and weather conditions. A strategy to incorporate these factors and parametric studies of potential energy savings from tightening buildings is presented.

1. A Review: Use of Data Mining Techniques to Detect Anomalies in Building Energy Consumption
Thulasi Ram Khamma, Student Member[1] and Mohamed Boubekri, Ph.D.[2], (1)University of Illinois Urbana Champaign, Champaign, IL, (2)School of Architecture, University of Illinois at Urbana-Champaign, Champaign, IL

2. Calculating the Energy Savings of Improving Building Envelope Airtightness in a Variety of Climates and Building Types
Lisa Ng, Ph.D., Member[1], Som Shrestha, Ph.D., BEMP, Member[2], Andre Desjarlais[3] and Steven Emmerich, Member[1], (1)National Institute of Standards and Technology, Gaithersburg, MD, (2)Oak Ridge National Laboratory, Oak Ridge, TN, (3)Oak Ridge National Lab, Oak Ridge, TN

Wednesday, August 10, 1:45 PM-3:00 PM

CONFERENCE PAPER SESSION 5 (INTERMEDIATE)

Life Cycle Cost and Economic Analysis

Room: Canyon B

Chair: Luke Troup, Student Member, Northeastern University, Boston, MA

This session covers Life Cycle Cost Analysis at a variety of scales. At a whole market level, an application of agent based modeling simulates the behavior of individuals and groups to predict market adoption of energy efficiency measures and their total energy savings. At the building portfolio level, some of the economic implications of energy efficiency that aren't typically considered are incorporated into a probabilistic model to assist decision-making. At the building level, a more flexible multi- objective optimization tool that allows HVAC system types to be optimized (instead of just the parameters of a specific system) is discussed.

1. Multi-Objective Optimization of Building Envelope, Lighting and HVAC Systems Designs
Weili Xu[1], Adrian Chong[1], Khee Poh Lam, Ph.D.[1] and Omer T. Karaguzel, Ph.D.[1], (1)Carnegie Mellon University, Pittsburgh, PA

2. Agent Based Modeling for Smarter Building Energy Simulation and Energy Efficiency Technology Evaluation
Ralph Muehleisen, Ph.D., P.E., Member[1], Joshua Bergerson, Ph.D.[1], Eric Tatara, Ph.D., P.E.[1], Diane Graziano, Ph.D.[1] and Nicholson Collier, Ph.D.[1], (1)Argonne National Laboratory, Lemont, IL

3. Energy Efficiency Portfolio Analysis Using LCCA and Uncertainty Analysis
Philip Keuhn[1] and Michael Gartman[1], (1)Rocky Mountain Institute, Boulder, CO

CONFERENCE PAPER SESSION 6 (BASIC)

Urban Scale Modeling

Room: Canyon A

Chair: Gustavo A. Carneiro, Georgia Institute of Technology, Atlanta, GA

Modeling at an urban scale requires more than serial modeling of individual buildings because of the number of models required and the potential for large scale and hybrid systems. Presenters describe a purpose-built tool for parametric modeling whole communities, a strategy for modeling and answering "what if" questions based on existing building information, and an example of modeling a complex hybrid system.

1. A Virtual Testbed for Net Zero Energy Communities
Wangda Zuo, Ph.D., Member[1], Dong He, Student Member[2], Sen Huang, Student Member[1] and Raymond Kaiser[3], (1)University of Miami, Coral Gables, FL, (2)Chongqing University, Chongqing, China, (3)Amzur Technologies, Inc., Tampa, FL

2. City Scale Modeling with OpenStudio
Daniel Macumber, Member[1], Kenny Gruchalla, Ph.D.[1], Nicholas Brunhart-Lupo, Ph.D.[1], Jennifer Melius[1], Julian Abbott-Whitley[1], Marjorie Schott[1], Alex Swindler[1] and Henry Horsey, Member[1], (1)National Renewable Energy Laboratory, Golden, CO

3. A Parametric Tool for Community-Scale Modeling
Peter Ellis, Member, Big Ladder Software, Denver, CO

SEMINAR 5 (INTERMEDIATE)

NZE Modeling I

Room: Alpine West

Chair: Drury Crawley, Ph.D., BEMP, Fellow ASHRAE, Bentley Systems, Inc., Washington, DC

As consumer interest, voluntary rating programs, and energy codes are increasingly pushing the market towards NZE, challenges in modeling these buildings are coming to light. This session investigates available NZE modeling strategies, challenges that arise, and how one model compares to actual monitored performance.

1. Are We Ready for the ZEB Challenge?
Surabhi Joshi[1] and Chitra Nambiar, AIA, Associate Member[2], (1)NORESCO, San Francisco, CA, (2)AIA, San Francisco, CA

2. High Performance Analysis from Cradle to Grave of a Net Zero Electrical Energy School
Sukreet Singh, BEMP, Affiliate, Cuningham Group Architecture Inc, Denver, CO

3. Modeling Challenges in Residential NZE Design
Carrie Brown, Ph.D., Member, Resource Refocus, LLC, Oakland, CA

4. Investigating Error in Predictive Modeling Using Post-Occupancy Monitoring of High Performance Home
Andres Fergadiotti, P.E.[1] and Will Vincent[2], (1)Southern California Edison, Rosemead, CA, (2)Between Built & Natural Environments, Rancho Santa Margarita, CA

SEMINAR 6 (INTERMEDIATE)

Simulation for Design I

Room: Alpine East

Chair: Pallavi Mantha, Sustainability Consultant, New York, NY

Energy modeling and environmental performance evaluation during the early stages of design are critical for the design, construction and operation of high performance buildings. This session provides strategies for high performance building design using cradle to grave analysis, setting performance goals using WELL and LEED rating systems, and developing rules-of-thumb to evaluate innovative design features. Design challenges and design options for net zero energy design of a high performance building are discussed along with the energy modeling, daylighting modeling and life cycle assessment that were done at every phase of the project.

1. Demystify a Rule of Thumb in Sustainable Design: Assessing Shading Strategy on West Facade
Eddy Santosa, CallisonRTKL, Seattle, WA

2. Simulation-Based Metrics in Well and LEED Rating Systems
Kapil Upadhyaya, BEMP[1] and Alfonso Hernandez[1], (1)Kirksey Architecture, Houston, TX

Wednesday, August 10, 3:30 PM-5:00 PM

CONFERENCE PAPER SESSION 7 (INTERMEDIATE)

HVAC Component Modeling and Load Analysis ll

Room: Canyon B

Chair: Susan Collins, Whole Building Systems, Charleston, SC

This session provides insights into modeling domestic hot water systems, PCM cooling systems, ECM fan/motor combinations and system sizing strategies. For domestic hot water modeling, recommendations are made based on examining different load calculation methods and comparing their predictions to actual multi-unit residential building meter data with respect to peak demand, load profile, and energy consumption. PCM modeling is demonstrated using EnergyPlus and validated with results from a fully functional installation in a London School. HVAC downsizing strategies considering thermal comfort performance attributes is presented as an innovative approach for system sizing.

1. Disparate Standards: Comparing Standard Domestic Hot Water Modelling Methods for Multi-Residential Buildings
Xiangjin Yang, Ph.D., BEMP, Associate Member[1] and Brian Tysoe, P.Eng., BEMP, Associate Member[1], (1)MCW Consultants Ltd., Toronto, ON, Canada

2. Impacts of HVAC Downsizing on Thermal Comfort Hours and Energy Consumption
Elvin Ruya[1] and Godfried Augenbroe[1], (1)Georgia Institute of Technology, Atlanta, GA

3. Evaluation of Fan Models for Application to ECM Fan/Motor Combinations
Dennis L. O'Neal, Ph.D., P.E., Fellow ASHRAE[1], Peng Yin, Ph.D., Student Member[1] and Douglas Ingram[1], (1)Baylor University, Waco, TX

CONFERENCE PAPER SESSION 8 (INTERMEDIATE)

Uncertainty Analysis

Room: Canyon A

Chair: Wangda Zuo, Ph.D., Member, University of Miami, Coral Gables, FL

This session offers several approaches to account and quantify energy modeling uncertainty during design and operation. The DOE Asset Score Preview feature demonstrates the use of certainty of each input which is used by a regression engine to calculate mean EUI as well as the minimum and maximum EUI which correspond to the 95% confidence interval of the calculated distribution. These values are mapped to the Asset Score scale to provide a user with an estimated score range for the preview building. This session also focuses on applying climate change forecasts to weather files during simulation and calculate the impact of variation in climatic conditions using Monte-Carlo simulation. Other topics include the development of schedule-based energy management strategies to minimize electricity procurement costs using mixed-integer linear programming; and applying uncertainty analysis techniques to identify the building parameters that have the largest energy impact on Thai detached houses.

1. Incorporating Climate Change Predictions in the Analysis of Weather-Based Uncertainty
Parag Rastogi, Student Member[1] and Marilyne Andersen, Ph.D.[2], (1)Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland, (2)École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

2. Energy Assessment and Uncertainty Analysis with DOE's Asset Score Preview
Supriya Goel[1], Henry Horsey, Member[2], Nicholas Long, Member[2] and Nora Wang[3], (1)Pacific Northwest National Laboratory, Portland, OR, (2)National Renewable Energy Laboratory, Golden, CO, (3)Pacific Northwest National Laboratory, Richland, WA

3. Uncertainty Distributions in Architectural Design Parameters for Thai Houses
Daranee Jareemit, Ph.D., Associate Member[1], Natthaumporn Inprom[1] and Jaruwan Sukseeda[1], (1)Faculty of Architecture and Planning, Thammasat University, PathumThani, Thailand

SEMINAR 7 (INTERMEDIATE)

ASHRAE Standard 209: Overview and Case Studies

Room: Alpine East

Chair: Drury Crawley, Ph.D., BEMP, Fellow ASHRAE, Bentley Systems, Inc., Washington, DC

This session provides an overview of ASHRAE Standard 209, Simulation Aided Design, which is a new process standard that sets minimum requirements for the use of building energy simulation in the design of new buildings. The Chair and committee members present the application of the standard using case studies for the early design and operational phases of a project. Some of the topics covered include load-reduction modeling, HVAC system selection modeling, comparison of modeled to actual energy consumption during the operational phase.

1. ASHRAE Standard 209 Overview
Jason Glazer, P.E., Member, GARD Analytics, Inc., Arlington Heights, IL

2. Case Studies of Early Design Analysis
Clark Denson, P.E., Member, Smith Seckman Reid, Nashville, TN

3. Case Study of Operations-Phase Analysis
David Reddy, Member, 360 Analytics, Seattle, WA

4. Question & Answer Session
Erik Kolderup, P.E., BEMP, Member, Kolderup Consulting, San Francisco, CA

SEMINAR 8 (BASIC)

Case Studies I

Room: Alpine West

Chair: Yu Joe Huang, BEMP, White Box Technologies, Moraga, CA

    This session focuses on case studies of energy modeling for high performance buildings and retrofit projects. One of the case studies provides design strategies and modeling tips to achieve net zero energy goals for an Office building meeting the Living Building Challenge requirements. Another case study highlights the complexity of modeling a large airport building with a wide variety of high performance building features. This session includes another case study of using energy modeling to evaluate potential energy saving opportunities for a post-war building.

1. Calgary Airport IFP: Best Practices for Modeling a Behemoth
Tristan Truyens, P.Eng., BEMP, Associate Member, DIALOG, Toronto, ON, Canada

2. Energy Modeling for the Living Building Challenge: A Case Study
David Griffin II, AIA, BEMP, Associate Member, Arch|Nexus, Salt Lake City, UT

Thursday, August 11

Thursday, August 11, 8:15 AM-8:45 AM

KEYNOTE

A Career in Energy Modeling

Room: Grand Ballroom

Chair: Annie Marston, Ph.D., BEMP, Ebert and Baumann Consulting Engineers Inc., Washington, DC; Arfa Aijazi, Student Member, Massachusetts Institute of Technology, Cambridge, MA; Pallavi Mantha, NA, NA, Lebanon; Elizabeth Gillmor, P.E., BEMP, Member, Energetics Consulting Engineers, LLC, Aurora, CO

    A question and answer session on what a career in energy modeling means from entry level to CEO with special emphasis on equality and mentorship. This session will begin with a discussion on equality in the simulation and wider engineering community and more importantly will discuss what a career in simulation means. Panelist will discuss how their careers have progressed including obstacles they have overcome and where they want their careers to go. An emphasis will be made on being different from the norm within our day to day lives and what lessons have been learned that we can pass on to the wider simulation community.

Thursday, August 11, 9:00 AM-10:30 AM

CONFERENCE PAPER SESSION 9 (INTERMEDIATE)

Automation and Scripting

Room: Alpine East

Chair: Chip Barnaby, Retired, Lexington, MA

    Since the introduction of Appendix-G in 90.1-2004, the Performance Rating Method has become the defacto standard for assessing the above code performance of energy efficient buildings. This session includes four papers covering the development of a ruleset for automating the requirements in 90.1-2010 Appendix G, tools and strategies to adopt the software development methods for energy modeling, development of OpenStudio measures and parametric analysis for identifying current technologies with maximum energy saving potential. Collectively these three papers provide energy

modelers with the necessary knowledge to apply Appendix-G requirements and develop workflows for improving the analysis process and reuse modeling components across projects.

1. Developing a Detailed Ruleset for Use in Automating the Performance Rating Method of ASHRAE Standard 90.1-2010

Supriya Goel[1], Michael Rosenberg, Member[2], Bing Liu, P.E., Member[2], Dimitri Contoyannis, P.E., Member[3] and Noah Czech[4], (1)Pacific Northwest National Laboratory, Portland, OR, (2)Pacific Northwest National Laboratory, Richland, WA, (3)Architectural Energy Corp, San Francisco, CA, (4)Noresco, Boulder, CO

2. Using Python and Eppy for a Large National Simulation Study

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

3. Modeling like a Programmer: Tools and Practices to Help You Model Better

Michael O'Keefe[1] and Peter Ellis, Member[1], (1)Big Ladder Software, Denver, CO

4. The Life Cycle of an OpenStudio Measure: Development, Testing, Distribution, and Application

David Goldwasser[1], Daniel Macumber, Member[1], Andrew Parker[1], Robert Guglielmetti[1], Larry Brackney, Ph.D.[1] and Edwin Lee, Member[1], (1)National Renewable Energy Laboratory, Golden, CO

CONFERENCE PAPER SESSION 10 (ADVANCED)

Combined Use of Tools/Co-Simulation

Room: Canyon A

Chair: Sen Huang, Student Member, Pacific Northwest National Laboratory, Richland, WA

BIM interoperability for energy simulation is rapidly evolving and this session includes two papers on how information is processed by various BIM tools to exchange data with simulation tools such as eQuest, EnergyPlus and IES. One case study of the mixed-use project in New York City uses a BIM workflow that allows for iterative design options and minimal data loss across platforms while importing the analysis results into the BIM model. Other tools and workflow include the use of OpenStudio's IFC import feature with a BIM Server to enable frequent and rapid evaluation of energy performance. In addition, this session also includes two other papers on co-simulation and modeling of electrochromic windows.

1. Co-Simulation for Control Design: A Case Study for Cross-Domain Collaboration

Eder Katharina[1], Edmund Widl[1], Conrad Gähler[2], Barabara Beiglböck[1] and Florian Judex[1], (1)AIT Austrian Institute of Technology, Vienna, Austria, (2)Siemens Schweiz AG, Zug, Switzerland

2. A BIM Workflow for Iterative and Informative Energy Modeling

Ryan Welch[1], Amy Egerter[2], Shanta Tucker, P.E.[2] and Christopher Connock[1], (1)KieranTimberlake Associates, LLP, Philadelphia, PA, (2)Atelier Ten, New York, NY

3. Leveraging Building Information Models in IFC to Perform Energy Analysis in Open Studio

Issa J. Ramaji[1], John Messner, Ph.D.[1] and Robert Leicht, Ph.D.[2], (1)The Pennsylvania State University, University Park, PA, (2)Pennsylvania State University, University Park, PA

4. Using MATLAB, DIVA and Energy Plus to Simulate Electrochromic Windows

Ahoo Malekafzali[1], Jianxin Hu, Ph.D.[2] and Wayne Place[2], (1)NCSU, Raleigh, NC, (2)North Carolina State University, Raleigh, NC

CONFERENCE PAPER SESSION 11 (INTERMEDIATE)

Occupant Comfort

Room: Canyon B

Chair: Carrie Brown, Ph.D., Member, Resource Refocus, LLC, Oakland, CA

This session focuses on modeling and analysis of occupant thermal and visual comfort. Daylight glare analysis is done for several alternative quatrefoil shading panels and configurations to calculate Daylight Glare Probability and select components to enhance visual diversity, and also as shading devices to reduce the excessive daylight exposure to future occupants. Another study uses parametric building energy simulations to systematically quantify the range of annual HVAC energy savings achievable through application of a novel mobile-based software technology entitled the Occupant Mobile Gateway (OMG). The OMG applies participatory sensing, indoor location and machine learning techniques to deliver actionable information to building energy management staff to optimize energy and indoor environmental quality performance goals.

1. The Effect of Balcony Thermal Breaks on Building Thermal and Energy Performance
Irina Susorova, Ph.D., BEMP, Member[1] and Ben Skelton, P.E., BEMP, Member[1], (1)Cyclone Energy Group, Chicago, IL

2. Daylight Glare Analysis for an All Glass Cathedral in Southern California
Chanyang Shin[1] and Greg Collins, P.E.[2], (1)Syska Hennessy Group, New York, NY, (2)Syska Hennessy Group, Los Angeles, CA

3. Energy Model Validation for Indoor Occupant Heat Stress Analysis
Seth Holmes, AIA, Member, University of Hartford, West Hartford, CT

4. Occupant-Aware Energy Management: Simulated Energy Savings Achievable through Application of Temperature Setpoints Learned through End-User Feedback
Kyle Konis, Ph.D.[1] and Leluo Zhang[1], (1)University of Southern California, Los Angeles, CA

SEMINAR 9 (INTERMEDIATE)

Simulation Techniques II

Room: Alpine West

Chair: Mohammed R. asl, Resource Refocus LLC, Menlo Park, CA

Energy modeling for net zero energy design requires advanced simulation techniques combining the energy, air flow and IAQ simulations. EnergyPlus and CONTAM are coupled using co-simulation based on the Functional Mock-up Interface (FMI) for Co-Simulation specification to design and evaluate the ability of buildings and their systems to meet demanding energy efficiency and IAQ performance requirements. Other presentations in this session include techniques to evaluate thermal comfort using PPD/PMV metrics, using energy modeling to evaluate energy conservation measures for ASHRAE Level 2 energy audits and strategies for modeling food process loads in energy models.

1. Food Process Loads in Energy Models: Estimating Methods from Conceptual Design to Construction Documents
Vernon Smith, P.E., Member, Smith Energy Engineers, LLC, Niwot, CO

2. Residential Design Decisions: a Case Study Using PPD/PMV Modeling to Drive Architectural and HVAC Choices for Enabling Thermal Comfort in a Cold Climate Home
Robert Bean, R.E.T., P.L.(Eng.), Member, Indoor Climate Consultants Inc., Calgary, AB, Canada

3. Modeling a Net Zero House with Combined Energy, Airflow and IAQ Simulations Using Co-Simulation Between EnergyPlus and CONTAM
W. Stuart Dols, Member, National Institute of Standards and Technology, Gaithersburg, MD

Thursday, August 11, 10:45 AM-12:00 PM

CONFERENCE PAPER SESSION 12 (INTERMEDIATE)

Energy Efficiency

Room: Canyon A

Chair: Supriya Goel, Pacific Northwest National Laboratory, Portland, OR

This session includes three papers focused on the modeling of advanced technology such as dynamic building envelope, simulating operational faults in HVAC control systems and supervisory control for peak reduction. EnergyPlus and EnergyPlus Runtime Language are used to model the performance of dynamic thermal envelopes made of phase-change materials and thermos or electro chromatic glazing. The second paper focuses on new operational fault modeling using three approaches to simulate operational faults with EnergyPlus. The last paper describes a supervisory control strategy for limiting peak power demand by small and medium commercial buildings while meeting the business needs of the occupants.

1. Modeling and Simulation of Operational Faults of HVAC Systems Using EnergyPlus
Rongpeng Zhang, Ph.D., Associate Member[1] and Tianzhen Hong, Ph.D., Member[2], (1)Lawrence Berkeley National Laboratory, Berkeley, CA, (2)LBNL, Berkeley, CA

2. A Method of Energy Simulation for Dynamic Building Envelopes
Julian (Jialiang) Wang, Ph.D.[1] and Liliana Beltran, Ph.D.[2], (1)University of Cincinnati, Cincinnati, OH, (2)Texas A&M University, College Station, TX

3. Supervisory Control for Peak Reduction in Commercial Buildings While Maintaining Comfort
Jibonananda Sanyal, Ph.D.[1], James J Nutaro[1], David Fugate[1], Teja Kuruganti[1] and Mohammed Olama[1], (1)Oak Ridge National Laboratory, Oak Ridge, TN

CONFERENCE PAPER SESSION 13 (INTERMEDIATE)

Optimization

Room: Canyon B

Chair: Erik Kolderup, P.E., BEMP, Member, Kolderup Consulting, San Francisco, CA

Simulation-based optimization has great potential to evaluate inter-related performance objectives of advanced technologies and identify optimal mix of technologies to realize maximum energy savings with minimum cost. This session includes three different approaches to optimization. The first one is based on simulation techniques combining optimization algorithms and simplified energy simulation tools; the second one is based on surrogate modeling to approximate the behavior of complex multivariable systems with a limited set of computationally intensive simulations and the third approach uses a multitude of tools including GenOpt for thermal properties optimization.

1. Comparison of Regression Techniques for Surrogate Models of Building Performance
Arfa Aijazi, Student Member[1] and Leon Glicksman, Ph.D., Fellow ASHRAE[1], (1)Massachusetts Institute of Technology, Cambridge, MA

2. An Optimization Tool for the Selection of Energy Saving Alternatives in Existing Households: Combining Building Performance, Renewable Energy, and Electric Vehicles
Gustavo A. Carneiro[1] and Godfried Augenbroe[1], (1)School of Architecture, Georgia Institute of Technology, Atlanta, GA

3. Steps Toward Designing a Positive Energy House: Lessons Learnt
Amir Rezaei-Bazkiaei, Ph.D., Member[1] and Raghuram Sunnam[2], (1)MKK Consulting Engineers, Greenwood Village, CO, (2)Baumann Consulting, Washington, DC

SEMINAR 10 (INTERMEDIATE)

Calibration

Room: Alpine East

Chair: Shanta Tucker, P.E., Atelier Ten, New York, NY

Energy models can be used for estimating the energy use of new construction, determining the best energy upgrades for existing construction and for analyzing the cost effectiveness of new energy efficient product development. This session demonstrates how modeling practices and tools can be improved by using post modeling measured energy use to calibrate modeling processes and tools, while considering uncertainty to make better forecasts and, therefore make better decisions.

1. Bayesian Calibration: Calibrating Energy Models while Considering Uncertainty
Ralph Muehleisen, Ph.D., P.E., Member, Argonne National Laboratory, Lemont, IL

2. Inverse Change-Point Modeling of Residential Building Energy Use Using Utility and Smart Meter Data
Kristen Cetin, Ph.D., P.E., Associate Member[1] and Nancy Nicho, Student Member[1], (1)Iowa State University, Ames, IA

3. Modeling, Calibration and Energy Efficiency Validation of Modified Atmosphere Insulation in an Army Facility
Tapan Patel, USACE ERDC-CERL, Champaign, IL

SEMINAR 11 (INTERMEDIATE)

Data and Interoperability

Room: Alpine West

Chair: Krishnan Gowri, Ph.D., Member, Autodesk, San Rafael, CA

For the full potential of building performance analysis and collaboration to be realized our industry requires standalone and multidisciplinary design, construction and operation software tools that have the capability to store data, exchange information and interoperate with each other. This session explains current developments in the "gbXML Software Validation Process for better BIM," the "BIM/GIS and Modelica Framework for Building and Community Energy System Design and Operation," and the recently published ASHRAE Standard 205P: "Standard Formats for Equipment Data Exchange" and how these standards and projects are increasing the quality, accuracy and interoperability of BIM and energy modeling tools worldwide.

1. ASHRAE Standard 205P: Standard Formats for Equipment Data Exchange
Charles Barnaby, BEMP, Life Member, Retired, Moultonborough, NH

2. Updates to the Green Building Xml (gbXML) Software Validation Process for Better BIM and Analysis Software Interoperability
Chien Si Harriman[1], Stephen Roth, P.E., Member[2] and Daniel Macumber, Member[3], (1)Carmel Software Corporation, San Rafael, CA, (2)Carmel Software Corp., San Rafael, CA, (3)National Renewable Energy Laboratory, Golden, CO

Thursday, August 11, 1:00 PM-3:30 PM

SPECIAL SESSION (INTERMEDIATE)

ASHRAE LowDown Showdown

Room: Grand Ballroom

Chair: Drury Crawley, Ph.D., BEMP, Fellow ASHRAE, Bentley Systems, Inc., Washington, DC

This year's challenge showcases the work of eight teams and over 80 participants, competing to model a net zero or below building. The baseline building is a 50,000 ft2, 3-story Outpatient Health Care facility.

Energy Derailment

Matt Biesterveld[1] and Sean Beilman[2], (1)Trane, La Crosse, WI, (2)BCER Engineering, Arvada, CO

Insane Energy Savers

Megan Tosh, P.E., Member[1] and Cory Duggin, P.E., Associate Member[2], (1)Integrated Environmental Solutions, Atlanta, GA, (2)TLC Engineering for Architecture, Brentwood, TN

Newbie Energizers

Andrew Corney, P.E., Member[1], Patrick McLaughlin[2] and Shermeen Yousif[3], (1)Sefaira, London, United Kingdom, (2)MHTN, Salt Lake City, UT, (3)Texas A&M University, College Station, TX

Outpatient Zero

Stephanie Egger[1] and Robert Larson[2], (1)Autodesk, San Francisco, CA, (2)DLR Group, Omaha, NE

Quest for Zero

Kevin Madison[1], Jeremy Lerond[1], Nick Caton[2] and Surabhi Joshi[3], (1)Madison Engineering PS, Seattle, WA, (2)Schneider-Electric, Lenexa, KS, (3)NORESCO, San Francisco, CA

The BEM Bang Theory

Benjamin Gonzalez, P.Eng., Associate Member[1] and Alfonso Hernandez[2], (1)CYPE, Alicante, Spain, (2)Kirksey Architecture, Houston, TX

The DeeBees

David Cocking, CEng[1] and James V. Dirkes II, P.E., BEMP, Member[2], (1)DesignBuilder Software Ltd, Stroud, United Kingdom, (2)The Bulding Performance Team Inc, Grand Rapids, MI

The EUI Evangelists

Harshul Singhal, Associate Member[1] and Annie Marston, Ph.D., BEMP[2], (1)Performance Systems Development, Ithaca, NY, (2)Ebert and Baumann Consulting Engineers Inc., Washington, DC

Thursday, August 11, 4:00 PM-5:00 PM

SPECIAL SESSION (INTERMEDIATE)

ASHRAE LowDown Showdown Q&A Session

Room: Grand Ballroom

Chair: Drury Crawley, Ph.D., BEMP, Fellow ASHRAE, Bentley Systems, Inc., Washington, DC

Participants will field questions from the audience about their presentations. Following the Q&A session, the audience will vote to recognize the teams in five categories.

Friday, August 12

Friday, August 12, 7:30 AM-8:00 AM

SPECIAL SESSION

Quick Tips for a Successful LEED Energy Model Submission

Room: Grand Ballroom

Chair: Dennis Knight, P.E., BEMP, Fellow ASHRAE, Whole Building Systems, LLC, Charleston, SC

Which LEED energy model submissions receive all LEED Optimize Energy Performance points pursued in only one phase of review? Those with thorough quality control paired with clear communication regarding the energy simulation inputs, outputs, and exceptional calculations. A thorough quality control process confirms proposed case model inputs match design documents, checks that Baseline inputs follow the referenced energy standard, evaluates simulation outputs compared to benchmarked data, confirms that savings per end-use align with efficiency measures, and spot-checks demand and equivalent full load hours of operation versus the inputs. This session provides tips for ensuring a successful LEED energy model submission.

Friday, August 12, 8:15 AM-10:00 AM

CONFERENCE PAPER SESSION 14 (INTERMEDIATE)

Data Visualization and User Experience

Room: Canyon B

Chair: Krishnan Gowri, Ph.D., Member, Autodesk, San Rafael, CA

Energy modeling, BIM and building performance analysis tools and real time monitoring systems generate large quantities of data that is often difficult to understand and explain in conventional alpha-numeric formats. Data visualization using automated graphic generation techniques can provide researchers, modelers, designers, owners, executives and decision makers the ability to quickly understand, absorb and communicate large amounts of data and complex concepts to improve design, construction, operation and asset management decision making processes. This session explains the value of using data visualization for net zero site energy design, verifying simulated control strategies, using integrated energy modeling with BIM, and for standardizing energy modeling output.

1. Standardizing Energy Modeling Output
Charles Eley, P.E., BEMP, Member, Eley Consulting, San Francisco, CA

2. Regression-Based Building Energy Performance Assessment Using Building Information Model (BIM)
Mohammad Rahmani Asl, Ph.D., Student Member[1], Weili Xu[2], Jin Shang, Ph.D.[1], Barry Tsai[1] and Ian Molloy[1], (1)Autodesk, Inc., San Francisco, CA, (2)Carnegie Mellon University, Pittsburgh, PA

3. Operation Diagnostics - Verifying and Validating Simulated Controls for Energy Models
Annie Marston, Ph.D., BEMP[1], Raghuram Sunnam[2], Claudio Tschaetsch[3] and Oliver Baumann, CPMP, Member[1], (1)Baumann Consulting, Inc., Washington, DC, (2)Baumann Consulting, Washington, DC, (3)Baumann Consulting, Inc., Washington, D.C., DC

4. Data Visualization for Net Zero Site Energy Design Using Solar Panels for Electricity and Hot-Water Heating Systems with Financial Incentives
Marionyt Tyrone Marshall, AIA, Associate Member, Perkins+Will, Atlanta, GA

CONFERENCE PAPER SESSION 15 (INTERMEDIATE)

Reality Capture for Modeling

Room: Canyon A

Chair: Dennis Knight, P.E., BEMP, Fellow ASHRAE, Whole Building Systems, LLC, Charleston, SC

The best way to reduce uncertainty and improve modeling forecasts is to study and compare modeling predictions with actual performance of existing buildings, then make adjustments and improvements to both modeling processes and tools. This session provides four case studies of using the capture and analysis of real building energy performance and test data to demonstrate how more accurate modeling is required to forecast aggressive energy conservation measure performance, to validate building performance rating systems, to improve modeling quality assurance and quality control and to make more accurate predictions of the effects of uncontrolled air leakage on building performance.

1. Integrating Whole Building Air Leakage Test Data into EnergyPlus Infiltration Models
Ned Lyon, P.E., Member[1] and Cheryl M. Saldanha, P.E.[2], (1)Simpson Gumpertz Heger Inc., Waltham, MA, (2)Simpson Gumpertz & Heger Inc., New York, NY

2. Automated Methods for Improving Energy Model Quality Assurance and Quality Control
Chris Balbach, P.E., BEMP, Associate Member[1] and David Bosworth, Member[2], (1)Performance Systems Development, Ithaca, NY, (2)BUILDlab, LLC, Dryden, NY

3. A Study of Energy Use in New York City and LEED-Certified Buildings
Cheryl Saldanha, P.E.[1] and Sean O'Brien, P.E., Member[2], (1)Simpson Gumpertz & Heger, New York, NY, (2)Simpson Gumpertz & Heger, Inc., New York, NY

4. Performance Based Outcomes: A Bookend Approach Project: Stone 34
Michael Frank, P.E., Associate Member, McKinstry Company, Seattle, WA

SEMINAR 12 (INTERMEDIATE)

IEQ and Ventilation Modeling

Room: Alpine West

Chair: Zulfikar Cumali, Energy Systems Consultant, San Francisco, CA

Modeling can be used to improve and optimize nearly all aspects of building design, construction and operational performance. This session provides three use cases for modeling natural ventilation to improve human comfort and IEQ using small, building integrated wind-exchangers; using CFD to improve life safety and indoor air quality in subterranean parking structures; and to model and mitigate the negative effects of 3D printer emissions on indoor air quality in an office building.

1. CFD Analysis of Natural Ventilation of an Isolated Generic Building with a Windward Window and a Venturi-Shaped Windexchanger
José Antonio Castillo Torres, Ph.D.[1] and Guadalupe Huelsz Lesbros, Dr.Ing.[1], (1)Institute for Renewable Energy UNAM, Temixco, Mexico

2. Modeling Concentrations of Ultrafine Particles and Volatile Organic Compounds Resulting from Emissions from Desktop 3D Printers with Multiple Filaments in an Office Space
Torkan Fazli, Student Member[1], Parham Azimi, Student Member[1] and Brent Stephens[1], (1)Illinois Institute of Technology, Chicago, IL

3. Performance-Based Modeling Analysis for Subterranean Parking Garage Carbon-Monoxide Ventilation System Design
Xiaolei Chen, Ph.D.[1] and Ning Wang, P.E.[2], (1)California State University, Los Angeles, CA, (2)Jensen Hughes, Los Angeles, CA

SEMINAR 13 (INTERMEDIATE)

Optimization and Economic Analysis

Room: Alpine East

Chair: Ralph Muehleisen, Ph.D., P.E., Member, Argonne National Laboratory, Lemont, IL

Building owners want better energy efficiency, optimized building performance and reliable economic performance. Energy modelers have to consider and balance energy performance and economic performance when making forecasts and recommending energy conservation measures. This session provides three case studies of how energy analysis and economic analysis were used to forecast the impact of a buildings shape and orientation on its energy consumption; to determine the cost effectiveness of a "Thermally Active Foundation" design as compared to a conventional ground coupled heat pump system; and, to improve the cost effectiveness of packaged energy conservation measures on utility demand side management programs.

1. Improving Utility DSM Program Cost Effectiveness through Building Energy Optimization
David Pudleiner[1] and Haider Khan[2], (1)ICF International, Fairfax, VA, (2)ICF International, Toronto, ON, Canada

2. Statistical Analysis of Impact of Building Morphology and Orientation on Its Energy Performance
Thulasi Ram Khamma, Student Member[1] and Mohamed Boubekri, Ph.D.[2], (1)University of Illinois Urbana Champaign, Champaign, IL, (2)School of Architecture, University of Illinois at Urbana-Champaign, Champaign, IL

Friday, August 12, 10:30 AM-12:00 PM

CONFERENCE PAPER SESSION 16 (INTERMEDIATE)

Model and Calibration Validation

Room: Canyon A

Chair: Ralph Muehleisen, Ph.D., P.E., Member, Argonne National Laboratory, Lemont, IL

Energy model validation and calibration techniques can be used for improving the energy use of new construction, determining the best energy upgrades for existing construction and for analyzing new building automation and control strategies. This session provides four use cases for how modeling practices and tools can be improved by using post modeling measured energy use to improve lighting control strategies; estimate the energy savings potential in the US residential building sector; better estimate building performance from large data sets where some sensored data is missing, and to improve an office buildings HVAC zone temperature and energy performance.

1. A High-Granularity Approach to Modeling Energy Consumption and Savings Potential in the U.S. Residential Building Stock
Eric Wilson[1], Craig Christensen[1], Scott Horowitz[1] and Henry Horsey, Member[1], (1)National Renewable Energy Laboratory, Golden, CO

2. Office Zone HVAC Energy Calibration from Easily Available Sensor Data
Tomoshi Otsuki, Ph.D.[1] and Mitsunobu Yoshida, Ph.D.[1], (1)Toshiba corporation, Kawasaki, Japan

3. Imputation of Missing Values in Building Sensor Data
Adrian Chong[1], Weili Xu[1], Khee Poh Lam, Ph.D.[1], Yunjeong Mo, Ph.D.[1] and Omer T. Karaguzel, Ph.D.[1], (1)Carnegie Mellon University, Pittsburgh, PA

CONFERENCE PAPER SESSION 17 (INTERMEDIATE)

Weather Data for Modeling

Room: Canyon B

Chair: Chip Barnaby, Retired, Lexington, MA

Selecting weather files to be used to analyze a building's energy use and for selection of HVAC systems and equipment is an important part of a modeler's responsibilities. Understanding how whether files are processed within a particular tools calculation methodology can have enormous impacts on a model's runtime and output. This session provides four presentations that detail how to correctly select, apply and modify weather file data for use in building simulation programs and explains their effects on uncertainty, runtime and quality control and for determining building energy code change cost effectiveness.

1. Estimating Sub-Hourly Solar Radiation and Effective Sky Temperature from Hourly Weather Data
Timothy McDowell[1] and Michaël Kummert[2], (1)Thermal Energy System Specialists, LLC, Madison, WI, (2)Polytechnique Montreal, Montreal, QC, Canada

2. Impact of ASHRAE Standard 169-2013 on Building Energy Codes and Energy Efficiency
Rahul Athalye, Associate Member[1], Bing Liu, P.E., Member[1] and Zachary T. Taylor[1], (1)Pacific Northwest National Laboratory, Richland, WA

3. Morphing Climate Data to Simulate Building Lifecycle Energy Consumption
Luke Troup, Student Member[1] and David Fannon[1], (1)Northeastern University, Boston, MA

4. Optimizing the Use of Reduced Weather Data Sets in Building Energy Simulations
Yu Joe Huang, BEMP, White Box Technologies, Moraga, CA

SEMINAR 14 (INTERMEDIATE)

Case Studies II

Room: Alpine East

Chair: Justin Lueker, Baumann Consulting, Inc., Washington, DC

A key part of learning how to create better models and improving on current practice for building performance analysis is to observe how our colleagues in the field have successfully applied current best practices to actual projects. This session provides three case studies that examine the use of building simulation to determine the risk of frost occurring inside masonry walls when upgrading envelope insulation; for analyzing district geothermal heating and cooling; and, for modeling high performance laboratory buildings.

1. A Practitioner's Solution for Modeling High Performance Laboratories
Matt Duffy, Affiliated Engineers, Inc., Madison, WI

2. Hygrothermal Simulation and Evaluation of Frost Risk of Masonry Walls Subjected to inside Insulation Retrofitting
Xiaohai Zhou, DSc[1], Dominique Derome, Ph.D.[2] and Jan Carmeliet, Ph.D.[1], (1)ETHZ - EMPA, Zürich, Switzerland, (2)EMPA, Dübendorf, Switzerland

3. Greening Small Town America: A Case Study in Utilizing Building Energy Simulation to Assess and Evaluate Performance of District Geothermal Heating and Cooling
Kristen Cetin, Ph.D., P.E., Associate Member[1], Nancy Nicho, Student Member[1] and Jeff Geerts[2], (1)Iowa State University, Ames, IA, (2)Iowa Economic Development Authority, Des Moines, IA

SEMINAR 15 (INTERMEDIATE)

Daylighting

Room: Alpine West

Chair: Amir Nezamdoost, Integrated Design Lab, University of Idaho, Boise, ID

Lighting contributes approximately one third of a buildings energy use. In addition, lighting has a significant impact on IEQ and indoor human comfort both visually and thermally. Daylighting analysis can significantly improve the lighting and daylighting components of a building's IEQ. This session provides three presentations focused on maximizing visual comfort, optimizing educational facility daylighting using window shading louvers, and integrating daylighting simulation into a BIM workflow.

1. A New Tool and Calculation Methods for BIM-Integrated Rapid Daylight Simulation
Jacob Dunn, Eskew+Dumez+Ripple, New Orleans, LA

2. Daylight Metrics Analysis for Louver Design Optimization in Educational Buildings
Jaewook Lee[1] and Mohamed Boubekri, Ph.D.[1], (1)School of Architecture, University of Illinois at Urbana-Champaign, Champaign, IL

3. Glare Reduction in Commercial Buildings: Maximizing Occupant Visual Comfort Using Two Modern Simulation Tools
Graham Linn, P.E., Member, Sustainable Engineering Group, Madison, WI