Wednesday, September 25

8:10 AM - 9:00 AM

Keynote 1

Renee Azerbegi

The Next Gen: Planning for a Regenerative and Resilient World

As we move towards increased frequency and severity of climate change threats, it will be imperative for our industry to design for a regenerative and resilient world. The architecture and engineering community is moving towards net-zero energy buildings, but what does it mean to take the next step and be regenerative, restorative, and resilient? Engineers and architects need tools, standards and simulation programs to define the next generation of buildings, after net-zero standards have already become a reality. How do we create net-positive buildings? How do we predict both the carbon impact of our buildings?

9:10 AM - 10:10 AM

Panel 1 (Intermediate)

Open-Source Software: Vision and Reality for Building Energy Modeling

Track: Modeling Innovation
Room: Four Square
Chair: Aaron Boranian, Big Ladder Software, CO
Over the past two decades the adoption of OSS has grown to become the backbone of software development for most web applications and the Internet today. For computer programming in general, OSS has delivered numerous benefits and has arguably accelerated an entire industry. This panel presents an overview of the fundamentals of OSS while also clearing up some

common misconceptions. Members of the panel representing software developers, federal government, and BEM practitioners will discuss the role that OSS plays at their organizations and the successes and challenges that they have experienced with OSS thus far.

1. Panel

Peter Ellis, Member[1]*, Amir Roth*[2]*, Chris Mackey*[3]*, Eric Ringold*[4] *and Juan Gonzalez*[5]*, (1)Big Ladder Software, Denver, CO, (2)Department of Energy, Washington, DC, (3)Payette, Boston, MA, (4)kW Engineering, CA, (5)Pacific Northwest National Laboratory, Richland, WA*

9:10 AM - 10:10 AM

Panel 2 (Intermediate)

Are We There Yet? A New Movement in Advancing the Performance-Based Code Compliance and Above-Code Program Using Energy Modeling

Track: Design Modeling

Room: Marco Polo

Chair: Bing Liu, P.E., Fellow ASHRAE, Northwest Energy Efficiency Alliance, Portland, OR

This panel introduces the new Energy Modeling Standard which was initiated by Canadian Standards Association and championed by government agencies, IBPSA, and utilities across U.S. and Canada. The purpose of this bi-national Standard is to provide a standardized modelling procedure and guideline, which leads to reduce the variances in modelling results. This panel also unveils the recent efforts in U.S. to develop a tool box that includes 1) standardized compliance forms for projects following the performance path of commercial energy codes; 2) project submittal review manual and checklist; and 3) specifications for third-party verifiers.

1. Are We There Yet?

Bing Liu, P.E., Fellow ASHRAE[1]*, Maria Karpman, BEMP, Member*[2]*, Duane Jonlin*[3] *and Rebecca Hudson*[4]*, (1)Northwest Energy Efficiency Alliance, Portland, OR, (2)Karpman Consulting, Glastonbury, CT, (3)City of Seattle, Seattle, WA, (4)U.S. Environmental Protection Agency, DC*

9:10 AM - 10:10 AM

Panel 3 (Intermediate)

Project StaSIO: Using Graphics to Communicate between Architects and Energy Modelers

Track: Modeling Deep Dives

Room: Red Rover

Chair: Supriya Goel, PNNL

For energy analysts, one of the most difficult challenges is condensing a great deal of data into an intelligible format so architects can understand it. For architects, one of the challenges in working with analysts is not knowing what performance-related questions can be asked and answered. A solution that connects both of these is IBPSA Project StaSIO, a crowd-sourced, public website that connects performance questions with graphics from simulation outputs that succinctly answers the question.

1. Getting to High Performance through Impactful Questions and Actionable Answers

Supriya Goel[1]*, Alejandra Menchaca, Associate Member*[2]*, Amarpreet Sethi, HBDP and BEMP, Associate Member*[3]*, Aman Singhvi*[4]*, Rakha Tarek*[5] *and Michael Sawford, Associate Member*[6]*, (1)PNNL, (2)Thornton Tomasetti, Boston, MA, (3)tk1sc, Seattle, WA, (4)AECOM, New York, NY, (5)Georgia Tech, (6)EDSL USA, Inc., New York, NY*

10:30 AM - 12:00 PM

Seminar 1 (Intermediate)

Lost in (BEM) Translation?

Track: Modeling Innovation

Room: Four Square

Chair: Sukreet Singh, Cuningham Group Architecture Inc, Denver, CO

BIM to BEM data interoperability is one of the most challenging issue many modelers are trying to overcome. This session features industry experts sharing their experiences and strategies for translating BIM model geometry for energy analysis. An integrated analysis/design environment native to a BIM authoring tool is discussed. Two other presentations cover tools and techniques for life cycle assessment and performance analysis topics beyond energy modeling including design questions such as embodied energy in the materials, plant growth and its interaction with climate, the impact of building height on wind-driven rain, and unexpected glare sources.

1. Geometry Translation Between Platforms: The Good, The Bad and The Ugly!
Amir Rezaei, Ph.D., Associate Member[1], *Michael Sawford, Associate Member*[2], *Andrew Corney*[3] *and Annie Marston, BEMP*[4], *(1)CannonDesign, NY, (2)EDSL USA, Inc., New York, NY, (3)Trimble, London, United Kingdom, (4)Ebert and Baumann Consulting Engineers Inc., Washington, DC*

2. BIM/BEM/BHOM: A Common Language and Platform for BIM/BEM Integration
Colin E Skinner, Associate Member*, BuroHappold Engineering, Los Angeles, CA*

3. Data Persistent Two-Way BIM To BEM Translation
Noah Pflaum[1] *and Chris Balbach, P.E., BEMP, Associate Member*[2]*, (1) National Renewable Energy Laboratory, Washington, DC, (2)Performance Systems Development, Ithaca, NY*

4. Beyond Energy: Problem Solving for the Uncommon Questions
Nicole Liana Peterson *and Alejandra Menchaca, Associate Member, Thornton Tomasetti, Boston, MA*

5. Integrating Energy Model Data into LCA Baseline
Victoria Herrero-Garcia[1] *and Rodrigo Castro*[2]*, (1) Ambient Energy, Denver, CO, (2)Bionova*

10:30 AM - 12:00 PM

Seminar 2 (Intermediate)

Net-Zero Performance Modeling

Track: Design Modeling
Room: Marco Polo
Chair: Ben Brannon, ARUP
This session includes four case studies of net-zero building design and an end-use analysis of the impact of ASHRAE 90.1-2016. Performance driven design decision making is demonstrated by the first presenter using anonymized energy models and metered data from over 100 multi-unit residential buildings. The second presentation provides a deeper understanding of the ASHRAE 90.1-2016 Performance-based compliance case study of an administrative building in Fort Collin, Co. Two design case studies include the design of an all-electric administrative-laboratory building and a student housing project.

1. Performance Driven Design: A Future of Energy Models Informing Key Design Decisions
Adam Barker[1]*, Samantha Menard*[2] *and Craig McIntyre*[2]*, (1)EQ Building Performance, Toronto, ON, Canada, (2)EQ Building Performance*

2. Context for Performance Cost Index 90.1-2016
Linda Morrison*, Ambient Energy, Denver, CO*

3. ASHRAE Standard 90.1-2016 End Use Analysis
Chitra Nambiar, Associate Member*, Pacific Northwest National Laboratory, Richland, WA*

4. Case Study: Modeling to Achieve Zero Net Energy For California Air Resources Board's New 400,000 SF Southern California Administrative, Laboratory And Vehicle Testing Facility
David W Conant Gilles*, Affiliated Engineers Inc., Madison, WI*

5. Driving to Net Zero: What Does It Take for A Student Housing Project?
Kevin Matthew Smith*, Glumac, Irvine, CA*

10:30 AM - 12:00 PM

Seminar 3 (Intermediate)

Dealing with Data

Track: Modeling Deep Dives
Room: Red Rover
Chair: Carrie Brown, Ph.D., Member, Resource Refocus, LLC, Oakland, CA
This session examines various data-driven methodologies, including using programming tools to clean and interpret raw M&V data, as well as leveraging data to vary inputs and instantly visualize results. The session introduces a method to estimate occupancy through an urban scale mobility model, illustrate how BuildHive techniques have been applied to evaluate and screen single-family homes for deeper energy efficiency, and finally provide details about the upcoming ASHRAE sponsored Kaggle Big Data Competition.

1. Mass Production: M&V Data Clean Up, Error Check and Visualization
Junru Shen*, Andrea Frisque, P.Eng., Associate Member and Sara Nikoofard, Stantec, Vancouver, BC, Canada*

2. Leveraging Data Analytics and Energy Modeling in Building Energy Design
Taylor Roberts, M.D., BEMP, Associate Member *and Eric Loew, Group14 Engineering*

3. Data Science Meets ASHRAE: The Great Energy Predictor Shootout III

Christopher Balbach, P.E., Member[1] *and Clayton Miller, Ph.D.*[2]*, (1)Performance Systems Development of NY, LLC, Ithaca, NY, (2)National University of Singapore, Singapore, Singapore*

4. A Data-Driven Urban Scale Mobility Model for Estimating Building Occupancy for EnergyPlus
Anne Sabine Berres[1]*, Piljae Im, Ph.D., Member*[2]*, Kuldeep Kurte, Ph.D.*[3]*, Melissa Allen, Ph.D.*[2] *and Jibonananda Sanyal, Ph.D.*[2]*, (1) Oak Ridge National Laboratory, (2)Oak Ridge National Laboratory, Oak Ridge, TN, (3)Oak Ridge National Lab, Oak Ridge, TN*

5. Enabling Large-Scale Data Collection and Analysis of Existing Buildings with BuildHive
Peter May-Ostendorp[1]*, Mudit Saxena, Member*[2] *and Bach Tsan, P.E.*[1]*, (1)Southern California Edison, Rosemead, CA, (2)Vistar Energy, Rocklin, CA*

1:40 PM - 3:10 PM

Seminar 4 (Intermediate)

Making Modeling Work for You

Track: Modeling Innovation
Room: Four Square
Chair: Susan Collins, Whole Building Systems, Charleston, SC
Want to learn more about using the Agile method to run your performance analysis team more effectively? Or using parametric workflows for more efficient HVAC modeling? This session will help you keep up with industry trends and practical approaches such as creating highly customizable modeling using high level data and using a spreadsheet-based interface for Open Studio.

1. Automatic Generation of Highly Customizable Energy Models from High Level input Data
David Goldwasser*, Matthew Dahlhausen and Marlena Praprost, National Renewable Energy Laboratory, Golden, CO*

2. Using Agile To Run Your Performance Analysis Team More Effectively - Lessons From Software Design
Andrew Corney*, Trimble, London, United Kingdom*

3. Efficient Parametric Workflows for HVAC Energy Modeling
Mingbo Peng*, Thornton Tomasetti, Boston, MA*

4. Keeping Up With The Trend: Energy Modeling for Every Project
Megan Gunther, P.E., Member*, Affiliated Engineers, Inc., San Francisco, CA*

5. A Spreadsheet-Based Interface for OpenStudio
Matthew Steen*, Ambient Energy*

1:40 PM - 3:10 PM

Seminar 5 (Intermediate)

Getting the Most Out Of A Building Performance Model: Innovative Ways To Get Answers Quicker

Track: Design Modeling
Room: Marco Polo
Chair: Amir Roth, Department of Energy, Washington, DC
This seminar takes a holistic approach to the improvement of simulation performance and discuss improvements that can be made by both developers and users of simulation programs. Focusing on the U.S. Department of Energy's EnergyPlus simulation engine, innovative simulation techniques and improvements to the underlying simulation techniques will be discussed. The 10X EnergyPlus project will be described and progress on this project will be summarized. Improvements to the component model approach will be described and discussed. Alternative approaches to shading and airflow calculations will be described.

1. Improving Pressure Network Model Performance
Jason DeGraw, Ph.D., Member*, National Renewable Energy Laboratory, Golden, CO*

2. 10X Energyplus
Tianzhen Hong, Ph.D., Member*, Lawrence Berkeley National Laboratory , Berkeley, CA*

3. GPU Shading: Not Just for Fortnite
Mark Adams, Member*, Oak Ridge National Laboratory, Oak Ridge, TN*

4. Component Modeling Enhancements in Energyplus
Edwin Lee, Member*, National Renewable Energy Laboratory, Golden, CO*

1:40 PM - 3:10 PM

Seminar 6 (Intermediate)

Indoor Air Quality and Thermal Comfort

Track: Modeling Deep Dives
Room: Red Rover
Chair: Lauren Wallace, The Epsten Group, Atlanta, GA

This session explores how radiant HVAC systems and air-based systems fair in energy analysis. Beyond air-based systems, we will also look at dynamic thermal modeling as designed using CFD software and best practices. In this seminar, we will also look at how computational analysis of a historic farmhouse lead to a unique systems study and problem-solving for extreme temperature ranges. We will compare modeling tools and how they perform for specific standards, such as ASHRAE and CIBSE. And finally, we will discuss an in-depth analysis of mixed-mode modeling for thermal comfort and the varied types of natural ventilation design.

1. Monitoring-Aided Computational Analysis of Comfort in a Historic Farmhouse
Sandeep Ahuja[1], *Patrick Chopson*[1] *and Ramana Koti, BEMP, Member*[2], *(1)Pattern R+D, (2)Lord Aeck Sargent, Atlanta, GA*

2. Insights from Comparing Radiant Hydronic Systems and Air-Based HVAC Systems Through Energy Simulation
Amy Allen[1], *Gregor Henze, Ph.D., P.E., Member*[1], *Kyri Baker, Ph.D.*[1] *and Gregory Pavlak, Ph.D., Member*[2], *(1)University of Colorado, Boulder, CO, (2)Penn State, State College, PA*

3. Natural Ventilation Modeling Workflows and Tool Validation
Fiona Woods*, Jared Landsman and Sengavi Thirupathy, Integral Group*

4. Thermal Comfort Evaluation of an Office Space with Integrated Analysis of Thermal Modelling and CFD Simulation
Sigal Shemesh *and Bing Wang, BuroHappold Engineering, New York, NY*

5. Fundamentals of Natural Ventilation & Case Study
Sukreet Singh, BEMP, Affiliate*, Cuningham Group Architecture*

3:30 PM - 5:00 PM

Seminar 7 (Intermediate)

Modeling Innovations

Track: Modeling Innovation
Room: Four Square
Chair: John Bynum, Ph.D., Member, WSP USA, San Francisco, CA

As industry needs evolve, modelling innovations are vital to ensure that practitioners can meet the changing industry needs. The innovations presented in this session vary from approaches to designing future modeling environments to novel methods for improving and documenting traditional model inputs. The session will include five presentations covering innovations in occupant load modeling, updates to the BESTEST modeling test cases, a method for conceptualizing building modelling software design, urban scale energy modeling to support large scale energy performance targets and policy development, as well as a schema for automating documentation development for validation modeling.

1. New Research on Modeling Occupant-driven Loads
Han Li, Associate Member[1], *Eric Wilson*[2], *Tianzhen Hong, Ph.D., Member*[3] *and Bing Dong, Ph.D., Associate Member*[4], *(1)Lawrence Berkeley National Laboratory, Berkeley, CA, (2)NREL, (3)LBNL, Berkeley, CA, (4)University of Texas at San Antonio, San Antonio, TX*

2. Improvements to ASHRAE Standard 140/BESTEST Building Thermal Fabric Modeling Test Cases
Joel Neymark, P.E., Member*, J. Neymark & Associates, United States*

3. Using a Jobs To Be Done Approach to designing simulation software
Andrew Corney*, Trimble, London, United Kingdom*

4. Machine Learning-based Methodology to Cluster Buildings into Archetypes for Urban Scale Building Energy Modeling
Maharshi Pathak*, NREL*

5. Hacking LEED: The Case for Standardizing Detailed Outputs
Matthew Steen*, Ambient Energy*

3:30 PM - 5:00 PM

Seminar 8 (Intermediate)

Maximizing Retrofits and Operational Improvements

Track: Design Modeling

Room: Marco Polo
Chair: Marcus Myers, WSP
This session consists of presentations covering energy optimization, automated fault diagnosis and detection, asset rating and retrofit opportunities assessments in existing buildings. The first presentation demonstrates an energy optimization technique to identify optimal solutions for HVAC and envelope improvements in a social housing building in Italy. The second presentation discusses the adoption of machine learning techniques as part of an Automated Fault Detection and Diagnosis system. A new tool for assessing the residential retrofit measures named XeroHomes is presented in this session with the field testing results from about 1,000 homes and their potential path toward achieving net-zero energy performance.

1. Energy Refurbishment Optimization Under Uncertainties For Social Housing Building
Ansley Barnard[1]*, Marco Manzan*[2] *and Alberto Clarich*[3]*, (1) ESTECO, Novi, MI, (2)University of Trieste, Trieste, Trieste, Italy, (3)ESTECO*

2. Automated Fault Detection and Diagnostics of Air-conditioning Units using Machine Learning Techniques
Parastoo Delgoshaei[1]*, W. Vance Payne, Ph.D., Member*[1] *and Mohammad Heidarinejad, Ph.D., P.E., Associate Member*[2]*, (1) National Institute of Standards and Technology, Gaithersburg, MD, (2) Illinois Institute of Technology, Chicago, IL*

3. XeroHome: a BEM-Based Targeting Tool for Residential Energy Retrofits
Mudit Saxena, Member[1]*, Peter May-Ostendorp*[2] *and Bach Tsan, P.E.*[3]*, (1)Vistar Energy, Rocklin, CA, (2)Vistar Energy, (3)Southern California Edison, Rosemead, CA*

5. An Asset Perspective to Evaluate Potential Building Energy Performance
Juan Gonzalez*, Abinesh Selvacanabady, Supriya Goel, Nora Wang, Dr.Eng, Alex Vlachokostas and Kevin Keene, Pacific Northwest National Laboratory, Richland, WA*

3:30 PM - 5:00 PM
Seminar 9 (Intermediate)

Urban Scale Modeling

Track: Modeling Deep Dives
Room: Red Rover
Chair: Carrie Brown, Ph.D., Member, Resource Refocus, LLC, Oakland, CA
This session focuses on various urban scale methodologies and tools, including an open source software development kit for urban energy modeling, a computing project for multiscale coupled urban systems, and a building and transportation integrated framework for urban energy use modeling. The session also reviews an analysis of the impact of building heat emissions on the urban microclimate using commercial prototype buildings, as well as urban scale calibration approaches to explore the technical potential of new technologies, the effect of energy efficiency on hourly demand, and the load growth and peak demand for utilities planning.

1. An Open Source Software Development Kit for Urban Energy Modeling
Daniel Lee Macumber, Member*, National Renewable Energy Laboratory, Golden, CO*

2. Introduction of an Exascale Computing Project: Multiscale Coupled Urban Systems
Tianzhen Hong, Ph.D., Member*, Lawrence Berkeley National Laboratory, Berkeley, CA*

3. Evaluating the Impact of Building Heat Emissions to Urban Microclimate
Xuan Luo*, Lawrence Berkeley National Laboratory, Berkeley, CA*

4. Calibration Approaches For Urban-Scale Energy Models
Dalton Jones *and Anthony D. Fontanini, National Renewable Energy Laboratory, Golden, CO*

5. An Integrated Framework for Urban Energy Use Modeling
Narjes Abbasabadi*, Illinois Institute of Technology, Chicago, IL*

Thursday, September 26

8:10 AM - 9:00 AM
Keynote 2

Rajan Rawal
The Global Cooling Prize

Affordable cooling is becoming a global necessity, supporting increased productivity, positive health outcomes, and accelerated economic development. The business-as-usual global increase in cooling demand will see the world go from 1.2 billion room air

conditioning (RAC) units in service in 2018 to 4.5 billion units by 2050. Developing countries will see a five-fold increase in demand over the same period with India alone seeing the adoption of about 1.0 billion RACs by 2050. The resultant increase in power demand would place a massive new burden on electricity grids.

9:10 AM - 10:10 AM

Panel 4 (Advanced)

Modeling Grid-Interactive Buildings

Track: Modeling Innovation
Room: Four Square
Chair: Ellen Franconi, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA
The modernization of the US electrical system is underway to create a clean, smart grid, which has vast market implications and significant potential benefit for many stakeholders. As the largest consumers of electricity, buildings have an important role to play. Buildings can provide demand flexibility using communication and control technologies to shift electricity use across hours of the day in response to continuously changing grid needs. Considering measures that support such grid-interactive efficient buildings (GEB) is a new topic for energy code development and other use cases that rely on building simulation performance modeling.

1. Building Stock Models to Support Evaluating Demand Response Technologies
Eric Wilson*, National Renewable Energy Laboratory, Golden, CO*

2. Advanced Control Methods and Strategies
Wangda Zuo*, University of Colorado, Boulder, CO*

3. Strategies for Optimizing Operation
Zahra Fallahi, Student Member*, University of Colorado, Boulder, CO*

9:10 AM - 10:10 AM

Panel 5 (Intermediate)

Integrating Graphs and Visualizations with Building Simulation for Informing Building Design

Track: Design Modeling
Room: Marco Polo
Chair: Carrie Brown, Ph.D., Member, Resource Refocus, LLC, Oakland, CA
This panel showcases processes adopted by consulting forms to push projects to achieve higher goals. It will showcase the latest efforts of multiple energy modeling tools in spatializing simulation outcomes, and represent possible next steps to inform architectural design through effective data visualization. Using examples from zero net energy and high efficiency projects, the presenters will discuss some strategies for presenting large simulation data sets clearly and succinctly to help answer performance questions.

1. Integrating Graphs and Visualizations with Building Simulation for Informing Building Design
Amarpreet Sethi, HBDP and BEMP, Associate Member[1] *and Margaret Pigman*[2]*, (1) tk1sc, Seattle, WA, (2)Resource Refocus LLC, Berkeley, CA*

9:10 AM - 10:10 AM

Panel 6 (Intermediate)

Making The Case For Custom Tool Development: In-house And Beyond

Track: Modeling Deep Dives
Room: Red Rover
Chair: Daniel Macumber, Member, National Renewable Energy Laboratory, Golden, CO
As the amount of analysis needs and the number of analysis tools grows, modelers are increasingly turning towards custom software and scripting capabilities to tie tools together. This approach has great potential to save time and money by automating workflows while simultaneously increasing quality by reducing errors. Companies value the increased productivity and efficiency of these tools. However, there can be some conflicting tensions in this new approach. How much should companies invest in these internal tools versus time on paying projects?

1. Making the Case For Custom Tool Development: In-house And Beyond

Daniel Macumber, Member[1]*, Kyleen Rockwell, BEMP, Member*[2]*, James McNeill*[3]*, Elizabeth Galloway*[4]*, Benjamin Brannon, P.E., BEMP, Associate Member*[5] *and Matthew Steen*[6]*, (1)National Renewable Energy Laboratory, Golden, CO, (2)HKS, Denver, CO, (3)Affiliated Engineers, Inc., Seattle, WA, (4)Payette, Boston, MA, (5)Arup, Lafayette, CO, (6)Ambient Energy, Denver, CO*

10:30 AM - 12:00 PM

Seminar 10 (Intermediate)

Improving Grid Interactions and Designing for Power Outages

Track: Modeling Innovation
Room: Four Square
Chair: Aaron Boranian, Big Ladder Software, CO
Similar to other commodities, electricity pricing is driven by supply and demand. The session informs attendees of novel approaches to reduce costs of electricity purchased for building operation. Topics include model-based predictive control of solar photovoltaic systems, the impact of electrochromic glazing on time dependent valuation and demand response, optimal design of microgrid assets (on-site generators, battery storage, renewable generation), combined forecasting of weather and building electrical demand, as well as calibration of community-scale building energy models to inform residential load-shifting decisions.

1. Model-based Predictive Control to Reduce Demand Charges with Distributed Photovoltaic System
Yuna Zhang, Ph.D., Student Member[1]*, Di Lu*[2] *and Godfried Augenbroe*[2]*, (1) Baumann Consulting, (2)Georgia Institute of Technology, Atlanta, GA*

1. Evaluating the Time Dependent Valuation (TDV) benefit of electrochromic glazing for T-24 Compliance
Ranojoy Dutta, HBDP and BEMP, Associate Member *and Sriranjani Ramachandran, View Inc, Milpitas, CA*

3. Critical Efficiency: Analyzing and Designing Microgrids to Improve Facility Resilience and Reliability
Alex Chapin, BEMP, Associate Member[1] *and Coles Jennings*[2]*, (1) Mason & Hanger, Glen Allen, VA, (2)Mason & Hanger*

4. Combined Day-Ahead Weather and Building Electrical Demand Forecasting
Anthony Florita, Ph.D., Member*, National Renewable Energy Laboratory, Golden, CO*

5. Community Energy Management: A calibrated Simulation-based Workflow using Nonlinear Optimization to Inform Residential Energy Use Load-shifting Behaviors
Rawad El Kontar*, National Renewable Energy Laboratory*

10:30 AM - 12:00 PM

Seminar 11 (Intermediate)

Enhancing Early Design

Track: Design Modeling
Room: Marco Polo
Chair: Lauren Wallace, The Epsten Group, Atlanta, GA
This session brings to light the concept of choice architecture, the pitfalls of systems designing, the TSPR metric for web-based compliance tools, guidelines for how to setup energy models for success, and how to best utilize THERM software. The session also walks you through how using specific tools can help to facilitate early decision-making as a part of the design process. It also walks through using IESVE for a residential project in Portland, Oregon. The session also includes a special presentation from Perkins+Will's Energy Lab on the development of the Simulation Platform for Energy Efficient Design (SPEED).

1. Benefits of Total System Performance Ratio- A HVAC System Level Metric
Supriya Goel*, Michael Rosenberg, Fellow ASHRAE and Juan Gonzalez, Pacific Northwest National Laboratory, Richland, WA*

2. Measuring the Impact of Enclosure Thermal Bridging on Whole Building Energy Models - Two Residential Case Studies
Monica Noelle Maragos*, Matthew Hyder and Sebastian Carrizo, RWDI, Portland, OR*

3. Simulation Platform for Energy Efficient Design (SPEED): A Web-Based, Cloud-Based, Parametric, Energy, Daylighting, and Solar Design and Analysis Platform for Architects
Benjamin Ross Welle, Ph.D., P.E.*, Perkins+Will, Chicago, IL*

10:30 AM - 12:00 PM

Seminar 12 (Intermediate)

Daylighting, Infiltration and IEQ

Track: Modeling Deep Dives

Room: Red Rover
Chair: Susan Collins, Whole Building Systems, Charleston, SC
The quest to improve the health and wellbeing of building occupants is generating new analysis and studies on the impact of daylighting, infiltration and natural ventilation on indoor environmental quality. This panel examines a number of approaches and improvements for modeling daylighting and IAQ that is reshaping our criteria for high performance commercial buildings. Topics addressed will include electronic glazing and the Time Dependent Valuation Method, the impact of window configurations and design criteria on investment analysis and certifications, infiltration of high-performance envelopes and an integrated framework for analyzing naturally ventilated buildings.

1. When Crisis Strikes: Passive Thermal Survivability Modeling
***Amir Rezaei, Ph.D., Associate Member**, arezaei@cannondesign.com, NY*

2. Enquiry Concerning LEED Daylight Criteria: Daylight Analysis of Different Window Configuration
***Sara Motamedi, Ph.D., Member**, Interface Engineering, San Francisco, CA*

3. Diodes and the Death of Daylighting as an ECM
***Sukreet Singh, BEMP, Affiliate**, Cuningham Group Architecture*

4. Infiltration Modeling in High-Performance and "Low-Load" Buildings
***Craig Simmons, P.E., BEMP**[1], Lisa Ng, Ph.D., Member[2] and Josh Talbert[3], (1)VEIC, Burlington, VT, (2)National Institute of Standards and Technology, Gaithersburg, MD, (3)VEIC*

5. An Integrated Simulation and Artificial Intelligence-Based Framework For Analyzing Indoor Air Quality For Urban Buildings
***Mehdi Ashayeri Jahan**, Illinois Institute of Technology*

1:00 PM - 3:30 PM

LowDown ShowDown

2019 ASHRAE LowDown Showdown

Chair: Annie Marston, Hurley Palmer Flatt, London, United Kingdom
The goal of the 2019 LDSd competition is to engage participants in a collaborative and fun learning experience that explores new advances in building science, modeling and technology. Teams are comprised of building analysts, designers, architects, engineers and other participants. Teams will be responsible for creating the architectural design and a performance analysis model based on model building data. The teams may use any software or a combination of software to complete their projects.

1.C.R.E.A.M. (Carbon Rules Everything Around Me)
***Jason Lackie**, WSP*

2.Highway to Sustainability
***Tina Lu Ting Chih**, Ove Arup & Partners Hong Kong Ltd*

3.Operation RESHED
***Meha Sharma**, DLR Group*

4.Ulti-Performance
***Michael Brown**, HKS Architects*

5.The Parametric Posse
***Walter Grondzik, P.E., Fellow Life Member**, Ball State University*

Friday, September 27

8:10 AM - 9:00 AM

Keynote 3

Dave Kang

Integrating Planning, Design, Construction and Operation to Reduce Life-Cycle Cost and Drive Sustainability and Resiliency

Facilities play a key role in the success of the University of Colorado Boulder's mission of education and research. Our buildings are expected to serve the needs of students, faculty and staff and, in doing so, they need to be both sustainable and resilient. As

our requirements grow, new buildings are planned and older buildings are updated. In either process, life-cycle cost--not first cost--of construction needs to be the new mantra of our facilities teams.

9:10 AM - 10:10 AM

Panel 7 (Intermediate)

Colorado Policies and Energy Modeling

Track: Modeling Innovation
Room: Four Square
Chair: Anna McCullough, P.E., Associate Member, Group14 Engineering, PBC, Denver, CO
This panel discusses how cities are implementing more aggressive climate policies and the effect these policies are having on the building sector, including the energy consulting business. We will discuss the development of the current policies in place and the processes each city took to develop them.

1. Colorado Policies and Energy Modeling
Anna McCullough, P.E., Associate Member[1], *Christin Whitco*[2], *Katrina Managan*[3] *and Christine Brinker*[4], *(1)Group14 Engineering, PBC, Denver, CO, (2)City of Boulder Planning & Sustainability, Boulder, CO, (3)City and County of Denver, Denver, CO, (4)Southwest Energy Efficiency Project*

9:10 AM - 10:10 AM

Panel 8 (Intermediate)

Automating Compliance Modeling: Challenges, Opportunities and Path Forward

Track: Design Modeling
Room: Marco Polo
Chair: Bing Liu, P.E., Fellow ASHRAE, Northwest Energy Efficiency Alliance, Portland, OR
Industry standards such as ASHRAE 90.1 and International Energy Conservation Code (IECC), that allow using energy modeling to document compliance or performance above code, typically involve comparing performance of the proposed design to a baseline design configured following the prescribed ruleset. The rulesets have grey areas and ambiguities that hinder consistent implementation by different software vendors; jurisdictions and above-code programs often deviate from the default 90.1 requirements; there is currently no software accreditation standard for 90.1 performance-based compliance and no formal process for evaluating and approving the software that implements the rulesets.

1. Automating Compliance Modeling: Challenges, Opportunities and Path Forward
Maria Karpman, BEMP, Member[1], *Larry Froess, P.E.*[2], *Amir Roth*[3] *and Muthusamy Swami*[4], *(1)Karpman Consulting, Glastonbury, CT, (2)California Energy Commission, CA, (3)Department of Energy, Washington, DC, (4)Florida Solar Energy, FL*

9:10 AM - 10:10 AM

Seminar 13 (Intermediate)

Advanced Methods for Grid Integration of High-Performance Residential Communities

Track: Modeling Deep Dives
Room: Red Rover
Chair: Lauren Wallace, The Epsten Group, Atlanta, GA
High-performance residential communities such as net-zero energy (NZE) and NZE-ready communities are emerging across the United States as many cities and states have committed to achieve ambitious energy efficiency and renewable energy goals between now and 2050. The achievement of these goals will transform the nation’s communities into the holistic paradigms consisting of pervasive solar photovoltaics (PVs) and other renewable distributed energy resources, energy storages and flexible loads. However, integrating residential communities with high PV penetration may bring many challenges to the grid. This seminar consists of four integral presentations that cover different aspects of a solution to these challenges.

1. Optimal Rooftop PV Placement in Net Zero Energy Communities
Rawad El Kontar*, National Renewable Energy Laboratory, Golden, CO*

2. Physics-based Gray-Box Dwelling Model for Building-to-Grid Integration Study
Jeff Maguire*, National Renewable Energy Laboratory, Golden, CO*

3. Machine-Learning-based End-Use Energy Consumption Estimation for Residential Buildings
Jianli Chen*, National Renewable Energy Laboratory, Golden, CO*

4. A Hierarchical Control System for Enhancing Reliability and Resilience of Residential Communities
***Xin Jin, Ph.D., Member**, National Renewable Energy Laboratory, Golden, CO*

10:30 AM - 12:00 PM

Panel 9 (Intermediate)

Using Energy Simulation in Net-Zero Carbon District Planning and Design: Case Studies, Approaches and Areas for Further Development

Track: Design Modeling
Room: Marco Polo
Chair: Philip Keuhn, Rocky Mountain Institute, Boulder, CO
This panel provides an overview of three case studies which leverage various simulation methods for district scale planning and design and provides insight into areas for methodology and tool improvement.

1. Using Energy Simulation
***Hayes Zirnhelt**[1], Victor Olgyay[2] and Matthew Jungclaus[2], (1) Whole System Energy Consulting, (2)Rocky Mountain Institute, Boulder, CO*

10:30 AM - 12:00 PM

Seminar 14 (Intermediate)

Modeling and Mitigating Effects of Heat Waves At Different Scales

Track: Modeling Innovation
Room: Four Square
Chair: Paulo Tabares, Ph.D., Associate Member, Colorado School of Mines, Golden, CO
Cities, buildings and their systems, including residential and commercial buildings, are designed based on historical weather data, however predictions of future climate scenarios in the U.S. demonstrate that weather and extreme events moving forward may be significantly different than current weather. This may have significant impacts on buildings, grid and occupants' health. This seminar covers recent research efforts to predict what short term and long-term future climate scenarios will be, and what impacts future climate weather data has on building and energy performance at the building, city and distribution scale.

1. Assessing and Reducing Heat Health Risks
***Olga Wilhelmi**, NCAR, Boulder, CO*

2. Indoor Exposure to Heat In The Age Of Mechanical Air Conditioning
***Amir Baniassadi, Ph.D., Member**, Harvard University, Cambridge, MA*

3. Robust Asset-and-User-Aware Power Grid Dispatch during Extreme Temperatures
***Salman Mohagheghi, Ph.D.**, Colorado School of Mines, Golden, CO*

4. City-Scale Modeling of Extreme Heat Events Using WRF-UCM Modeling with Bias Correction
***Kristen Cetin, PhD, PE, Associate Member**, Iowa State University, Ames, IA*

10:30 AM - 12:00 PM

Seminar 15 (Intermediate)

Systems and Components

Track: Modeling Deep Dives
Room: Red Rover
Chair: Megan Gunther, P.E., Member, Affiliated Engineers, Inc., San Francisco, CA
This session of five presentations covers a variety of system and component level modeling methodologies and developments. The topics include the development of a model in EnergyPlus for wastewater heat recovery systems, development of a dual purpose solar thermal collector using COMSOL modeling and lab testing, modeling methodologies for multiple air system configurations in EnergyPlus, modeling of air-source heat pump based central plants in EnergyPlus, and connecting field measurements of an existing cold climate hospital envelope performance to design phase modeling.

1. Modeling of Wastewater Heat Recovery Heat Pump Systems
***Nick Smith** and Steve Dowd, Affiliated Engineers, Chicago, IL*

2. Modeling Zones with Multiple Air Systems: Dedicated Outdoor Air Systems to Air Handling Units
***John R. Kramer**, Ambient Energy, Denver, CO*

3. Modeling of a Novel Dual Purpose Solar Thermal Collector Developed for Both Heat and Cold Collection

***Yao Yu, Ph.D., BEMP and BEAP, Associate Member**, North Dakota State University, Fargo, ND*

4. Modeling a Central Air-Source Heat Pump on an Energy Efficient Laboratory in Seattle Washington
***Justin Scott Shultz, Ph.D., Associate Member**, EYP Architecture & Engineering, Washington, DC*

5. When the Client Asks: Can your Model Confirm my Design Day Field Measurements
***Kyleen Rockwell, BEMP, Member**, HKS, Denver, CO*