



2021 ASHRAE Building Performance Analysis Conference

November 10th - November 12th, 2021

Tuesday, November 9

Tuesday, November 9, 10:30 AM - 12:00 PM

Panel 1 (Intermediate)

ASHRAE Standard for Evaluating Ruleset Implementation in Building Performance Modeling Software

Room: **VIRTUAL**

Chair: Amir Roth, US Dept. of Energy

Energy modeling, increasingly used for code and beyond-code compliance using rulesets like ASHRAE Standard 90.1 Performance Rating Method (Appendix-G), is complex, error-prone and currently requires manual verification. This seminar discusses ASHRAE Standard 229P, which will establish a BEM tool and ruleset independent framework to automatically verify the implementation of modeling rulesets. The Standard will facilitate the automation of submittal reviews and improve the consistency of compliance outcomes thereby reducing the burden on rating authorities and jurisdictions that adopt performance-based codes. Initially, Standard 229P will focus on Appendix-G, but can be easily adapted for other rulesets (ie: RESNET-HERS, CA-ACM).

1. Overview of ASHRAE Standard 229P

Supriya Goel, Pacific Northwest National Laboratory

2. Development of RMR

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

3. Development of RMR Tests

Maria Karpman, BEMP, Member, Karpman Consulting, Glastonbury, CT

4. Development of RCT

James McNeill, Pacific Northwest National Laboratory

5. Performance Based Codes

Michael Rosenberg, Fellow ASHRAE, Pacific Northwest National Laboratory

Tuesday, November 9, 1:00 PM - 2:30 PM

Panel 2 (Intermediate)

Data Exchange Mechanisms for Design and Analysis

Room: **VIRTUAL**

Chair: *Supriya Goel, Pacific Northwest National Laboratory*

Data exchange mechanisms, such as gbXML, BDE, RMR, and BuildingSync define data schemas for representing building data for specific purposes. The schemas allow data to be easily exchanged between users and software. The schemas facilitate the use of multiple analytical tools and minimize manual effort involved in mapping and transforming data across multiple tools and workflows. This panel introduces these schemas, discuss use-cases, and highlight efforts to improve data exchange. A moderated discussion addresses the merits and challenges associated with data exchange mechanisms and how these can streamline the workflow of design, analysis, code compliance, and energy audits.

1. Data Exchange for Design Using Gbxml

Stephen Roth, P.E., Member, Carmel Software Corporation, San Rafael, CA

2. Overview of Building Data Exchange

Sagar Rao, Member, Affiliated Engineers, Inc., Madison, WI

3. Ruleset Model Report for Compliance Reporting and Verification

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

4. Buildingsync Schema for Audit Data

Nicholas Long, P.E., Member, National Renewable Energy Laboratory, United States of America, Golden, CO

Wednesday, November 10

Wednesday, November 10, 8:10 AM - 9:00 AM

Keynote (Intermediate)

Josh Radoff

Decarbonization at Scale

Room: *Marco Polo*

Chair: *John Bynum, Ph.D., Member, ARUP, Dublin, Ireland*

The race is on. Decarbonization must take place at a rapid pace across all sectors of our economy. At least 50% reduction by 2030. And zero carbon by 2040. We know the general blueprint for how to get there, but we also need to revisit out basic assumptions of what each building, district, campus, and city is trying to achieve. Is net zero energy still the right goal? Probably not. Do our renewable procurement methods currently deliver the goals we want to see? Again, likely no.

Wednesday, November 10, 9:10 AM - 10:10 AM

Seminar 1 (Intermediate)

Advancements in Controls, Airflow Modeling and Operations

Room: *Marco Polo*

Chair: *Lauren Wallace, The Epsten Group, Atlanta, GA*

This session covers a variety of topics including the integration of CFD modeling into the mainstream architectural design process, the development of a continuous improvement process for pandemic resilience focusing on operational strategies, and advanced lighting controls for a factory building using an Artificial Neural Network (ANN) model based on detailed physics.

1. Evaluation of a Framework for the Integration of CFD into the Early Stages of Architectural Design Using Delphi Method

Soo Jeong Jo¹ and James Jones, Ph.D.², (1) Louisiana State University, Baton Rouge, LA, (2) Virginia Tech, Blacksburg, VA

2. Streamlined Process for Improving Pandemic Resilience in the Built Environment

Nancy McClellan, MPH, CIH, CHMM, American Industrial Hygiene Association, Falls Church, VA

3. Deep Deterministic Policy Gradient-Based Lighting Control for a Factory Building

Young-Sub Kim and Cheol-Soo Park, Ph.D., Seoul National University, Seoul, Korea, Republic of (South)

Wednesday, November 10, 10:30 AM - 12:00 PM

Seminar 2 (Intermediate)

Existing Building and Analysis

Room: Marco Polo

Chair: Dru Crawley, IBPSA-USA, Oakland, CA

This session covers multiple topics related to analysis of existing buildings. The first presentation discusses challenges with modeling historic existing buildings, providing an overview of the many enclosure-related applications for computer modeling in the renovation of historic buildings. The second presentation talks about using Bayesian inference for parameter identification in building energy modeling for existing buildings. The third presentation discusses the importance of operation data and how the year 2020 was an anomaly and can provide insights that can lead to more accurate holiday and weekend occupancy and equipment profiles.

1. An Overview of Building Energy Modeling Enclosure-Related Applications in Historic Building Renovations

Abigail Sefah, Simpson Gumpertz & Heger, Boston, MA

2. Guideline of Parameter Identifiability Analysis for Bayesian Inference of Building Energy Model

Seon Jung Ra, Dong Hyuk Yi, Ph.D. and Cheol-Soo Park, Ph.D., Seoul National University, Seoul, Korea, Republic of (South)

3. 2020 Operational Data Is Gold

Alex Lowrie, Little Diversified Architectural Consulting, Charlotte, NC

Wednesday, November 10, 1:40 PM - 3:10 PM

Seminar 3 (Advanced)

Optimizing Buildings for Zero Carbon Lifetime Operations

Room: Marco Polo

Chair: Jamy Bacchus, P.E., Member, ME Engineers, Denver, CO

This session is a follow-up to our 2020 ASHRAE BPAC session: 30-yr GHG Forecasts Using Marginal and Average Emissions, where we reviewed office buildings' lifetime emissions using NREL's hourly Cambium data for multiple cities. We will now attempt to minimize the buildings' operational carbon by employing various strategies including electrification, onsite renewables, load shifting and battery storage. Inevitably some regional electrical grids and buildings will have better alignment with 24/7 options for low carbon energy while others will struggle with limited onsite resources and a carbon intensive grid. We will apply NREL's ZEB 2.0 methodology to our zero carbon goals.

1. Optimizing Buildings for Zero Carbon Lifetime Operations: Intro

Caitlin Anderson, P.E., Member, ME Engineers, Denver, CO

2. Optimizing Buildings for Zero Carbon Lifetime Operations: Onsite Renewables

Sedighehsadat Mirianhosseinabadi, Ph.D., ME Engineers, Golden, CO

3. Optimizing Buildings for Zero Carbon Lifetime Operations: Storage

Jamy Bacchus, P.E., BEMP, Member, ME Engineers, Denver, CO

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

Seminar 4 (Intermediate)

Facilitation of Modeling, Cost Analysis and Behavioral Change

Room: Marco Polo

Chair: Aaron Boranian, Associate Member, Big Ladder Software, Denver, CO

This session starts with a presentation that analyzes two case studies for two LEED Platinum and Living Building Certified projects by covering aspects among the projects that affect occupant behavior. The second presentation will present lessons learned in the development of analysis tools intended for architects while trying to provide input to design teams in a cost-effective manner. The third presentation introduces new cost evaluation resources compiled by Glumac Inc. to inform the selection of building energy efficiency measures, increasing their chances of inclusion in final designs.

1. Update of ASHRAE Standard 140/Bestest Thermal Fabric Modeling Test Cases

Joel Neymark, P.E., Member, J. Neymark & Associates, Golden, CO

2. The Cost of Multifamily Energy Efficiency in Oregon

Katherine Anderson, Glumac, Portland, OR

Thursday, November 11

Thursday, November 11, 8:10 AM - 9:00 AM

Keynote (Intermediate)

Sue Reilly

Lessons for the Twenties

Room: Marco Polo

Chair: Aaron Boranian, Associate Member, Big Ladder Software, Denver, CO

This presentation draws from our experience and highlights our projects, technology and partnerships that are launching us into the 2020's. Projects include zero energy multifamily and offices. On the technology side, we've been working with a multitude of heat pump and energy recovery applications for colder climates. In addition to our traditional clients, we are partnering with jurisdictions and research organization on energy codes and electrification. All this activity bodes well for our industry and our climate.

9:10 AM - 10:10 AM

Seminar 5 (Intermediate)

Modeling Advances I

Room: Marco Polo

Chair: Dru Crawley, IBPSA-USA, Oakland, CA

This session conveys recent developments that have been made for simulation of novel technology and controls in addition to updates to industry standards that evaluate simulation tool accuracy. The first presentation presents a new DX cooling coil model in EnergyPlus that can provide precise control over temperature and humidity simultaneously. The second presentation discusses updates to the thermal fabric test cases in ASHRAE Standard 140, the gold standard for modeling tool accuracy. The third presentation discusses new CBECC-Res capabilities for simulating load shifting potential of demand response heat pump water heaters.

1. A New DX Coil Model with Subcool and Reheat Modes in EnergyPlus

Lixing Gu, Ph.D., P.E., Member, Florida Solar Energy Center, Cocoa, FL

2. Lessons from Making Software for Architects

Andrew Corney, Trimble, London, United Kingdom

3. Simulating Demand Response Heat Pump Water Heaters for California Code Compliance

Aaron Boranian, BEMP, Associate Member¹ and Ben Larson², (1) Big Ladder Software, Denver, CO, (2) Larson Energy Research, Menomonie, WI

Thursday, November 11, 10:30 AM - 12:00 PM

Seminar 6 (Intermediate)

Unmet Hours --LIVE!

Room: Marco Polo

Chair: Aaron Boranian, Associate Member, Big Ladder Software, Denver, CO

This session presents attendees with an opportunity to interact with their peers and "crowd source" answers to their burning questions. This is the same intent as unmethours.com -- the question-answer forum for building energy simulations but offered in a live, interactive, and dynamic format for conference attendees. Participants are given time to think of a challenge they are facing before presenting their problem to a group for brainstorming. This allows participants to seek out as well as provide peer-supported advice on solving each other's challenges. What answers will you find (or give) in Unmet Hours -- LIVE?

Thursday, November 11, 1:30 PM - 3:30 PM

LowDown ShowDown (Intermediate)

2021 ASHRAE LowDown Showdown Modeling Competition

Team Presentations

Chair: John Bynum, Ph.D., Member, ARUP, Dublin, Ireland

The 2021 LowDown Showdown model building will be located in Puerto Rico. Participating Teams will design a 75,000 sf, residential care center located at a site on the island to be chosen by each team. The building will contain residences, offices, amenities and clinical spaces.

1. Agua Viviente

Dustin Lane, BMA Mechanical Plus

2. Al-Khwarizmi's Team

Marwa Alkurdi, ISG

3. C +VE (Carbon Positive)

Aaditya Patel, Stantec

4. Faro de Luz

Alfred Uzokwe Jr., GSA

5. MARKEL

Ashu Gupta, Member, Design To Occupancy, Jaipur, India

6. Shunya Power

Pinaki Acharya, Apogee Consulting Group, P.A.

7. The Carbonbusters

Abbott Price, BR+A

8. The Planeteers

Forest Tanier-Gesner, PAE

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

LowDown ShowDown (Basic)

2021 LowDown Showdown Judges' Q&A

Chair: John Bynum, Arup

Friday, November 12

Friday, November 12, 8:10 AM - 9:00 AM

Keynote (Intermediate)

Lauren Wallace

The Silver Lining to a World Under Fire: Our IQ Re IAQ is on the Rise

Room: Marco Polo

Chair: John Bynum, Ph.D., Member, ARUP, Dublin, Ireland

57,000 wildfires. 2,460,000 global COVID-19-related deaths. The year 2020, a year we all wish to forget, had a lasting, devastating impact worldwide. For us, it was a pivotal year that turned everyone's attention towards indoor air quality. Why did it take a world on fire and a global pandemic for our industry to finally start acknowledging indoor air quality concerns? And furthermore, how do we begin to understand something we can't see, hear, or feel? Confounding and conflicting advice over the entire span of 2020 made our work in indoor air quality that much harder, yet that much more important. The bad news is that SARS-CoV-2 is not the first, nor will it be the last, airborne virus. The good news is our toolkit to understand, measure, improve and maintain indoor air quality has grown rapidly.

Friday, November 12, 9:10 AM - 10:10 AM

Seminar 7 (Intermediate)

Passive Survivability, Resiliency and Modeling for the Future

Room: Marco Polo

Chair: Walter Grondzik, P.E., Fellow Life Member, Ball State University, Muncie, IN

Rapidly changing climate and weather patterns are placing new structural and thermal stresses on buildings, and effective responses are needed to maintain building structural integrity, thermal function and community-wide health, safety, and economic resilience. The first presentation evaluates the ability of dynamic glazing to diminish summer solar heat gain in highly

glazed office buildings. The second presentation from the National Centers for Environmental Information analyzes whether the changing climate conditions warrant updating climate normals for building performance simulation programs and how they impact a prototype building. The third presentation discusses the intersection of building-level energy resilience and community resilience with respect to continuity in business functions and food access during interruptions to grid power.

1. Improving Thermal Resilience with Dynamic Glazing: A Case Study

Ranojoy Dutta, BEMP and HBDP, Associate Member, View Inc, Milpitas, CA

2. Normal (Climate) Is Changing: How Does That Impact Building Simulation Results?

Drury Crawley, Ph.D., BEMP, Fellow ASHRAE¹ and Linda Lawrie, Member², (1)Bentley Systems, Inc., Washington, DC, (2)DHL Consulting LLC, Pagosa Springs, CO

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

Seminar 8 (Intermediate)

Urban Scale Modeling I

Room: Marco Polo

Chair: Aaron Boranian, Associate Member, Big Ladder Software, Denver, CO

This session delves into urban building energy modeling (UBEM). The first presentation describes an approach to assessing the energy resilience of an urban district against various anticipated threat conditions. The second presentation discusses how changes in rooftop solar reflectivity and thermal emissivity affect annual building utility costs across 15 climate zones. The third presentation talks about UBEM for a small city, which was used to establish a tiered building retrofit program.

1. Modeling the Resilience of Interacting Energy Networks at Urban Scale

Michael O'Keefe, Big Ladder Software, Denver, CO

2. The Impact of Optimal Rooftop Radiative Property Combinations on Urban Airshed: Simulations for 15 Climate Zones in the U.S.

Jyothis Anand, Student Member and David Sailor, Arizona State University, Tempe, AZ

3. Using Urban Building Energy Modeling to Meet Emissions Reduction Targets in a Small American City

Zachary Berzolla, Student Member, Massachusetts Institute of Technology, Cambridge, MA

Closing Session