Sunday, February 9

Sunday, February 9, 8:00 AM - 9:00 AM

Paper Session 1 (Basic)

Novel Strategies for Natural Ventilation

Track: Fundamentals and Applications

NY PDH G

Room: Orange E

Chair: Scott Sherwood, Full Member, Eco Care Corporation, NEW YORK, NY

This session discusses new and innovative strategies for natural ventilation for different situations, from Pharonic Tomb site to cutting edge technology and energy efficient buildings.

1. Natural Ventilation for Life and Death Sites Merenptah Tomb Architecture (OR-25-C001)

*Adel Yasseen, Professor[1], Mohamed ElAttar, Professor[2] and **Hesham Mohamed Safwat Osman, PhD, Full Member**[3], (1)Faculty of Graduate studies and Environmental Research, Ain Shams University, Cairo, Egypt, (2)Architectural Department, Faculty of Engineering, Mansoura University and the British University in Egypt, Cairo, Egypt, (3)Faculty of Engineering, the British University in Egypt, Green Communities Group Leader, Farouk ElBaz Sustainability Research Center of Excellency, Cairo, Egypt*

2. Development and Application of Automatic Window Control for Ventilation Based on Real-Time Room IAQ Measurements and Human Location Detection System (OR-25-C002)

***Jurgis Zemitis, Dr. Sc. Ing.**, Anatolijs Borodinecs, Dr. Sc. Ing., Full Member, Aleksandrs Zajacs, Dr. Sc. Ing., Egons Lavendelis, Dr. Sc. Ing., Arturs Ardavs, Mg.Ing. and Marta Zemite, Mg. Ing., Riga Technical University, Latvia, Latvia*

8:00 AM - 9:00 AM

Paper Session 2

Industry-Wide Artificial Intelligence

Track: Fundamentals and Applications

NY PDH G

Room: Orange F

Chair: Marilyn Listvan, Listvan Consulting (IAQ, Quality, Sensors), Edina, MN

This session highlights the transformative role of AI in the building industry through three perspectives: generative AI's potential for sustainability, an open-source library for leveraging LLMs in energy modeling, and the EU's Smart Readiness Indicator (SRI) framework for assessing smart building capabilities.

1. Navigating the Integration of Generative AI in Building Industry (OR-25-C004)

***Hanlong Wan, Ph.D., Associate**, Jian Zhang, Ph.D., Full Member and Yan Chen, Ph.D., Full Member, Pacific Northwest National Laboratory, Richland, WA*

2. An Open-Source Large Language Model-Based Agent Library for Building Energy Analysis and Modeling (OR-25-C005)

***Liang Zhang, Assistant Professor, Associate**, The University of Arizona, Tucson, AZ*

8:00 AM - 9:00 AM

Paper Session 3

Phase-Change Materials and Heat Exchangers for Innovative Thermal Management

Track: Fundamentals and Applications

Room: Orange G

Chair: Jubair A. Shamim, Oak Ridge National Laboratory, Full Member, Oak Ridge National Laboratory, OAK RIDGE, TN

Phage-change materials (PCM)-based thermal energy storage (TES) systems are increasingly being used for thermal management in buildings and other applications, with the aim of tailoring energy demand and optimizing the use of renewable energy. Various applications require the TES to have a high energy density and a compact design. In this session, papers go into more detail about how PCM-based TES can be used for home heating and hot water, the pros and cons of using metal or polymers as heat exchangers for TES devices, and how different thermal conductivity enhancers can change the performance of PCM-TES.

1. Thermal Performance of PCM Heat Sink with Fins, Metal Foam and Nanoparticles Under Extreme Thermal Conditions (OR-25-C007)

Sangwook Lee, Student[1] *and* ***Hoseong Lee***[2]*, (1)Korea university Optimized Energy Conversion Systems Lab, Seoul, Korea, Republic of (South), (2)Korea University, Seoul, Korea, Republic of (South)*

2. Prediction of Low-Cost Thermal Energy Storage, Tube Bank Characteristics Using Analytical Models (OR-25-C008)

Casey Josh Troxler, Student*, Jared Caleb Williams, Student, Rafael M Rodriguez and Sandra K.S. Boetcher, S-B-a Member, Embry-Riddle Aeronautical University, Daytona Beach, FL*

3. Multilevel Performance Evaluation for Successive Generations of a Phase-Change Material Thermal Storage Device (OR-25-C009)

James Wilson, Dr*, Manyu Zhang and Robert Barthorpe, University of Sheffield, Sheffield, United Kingdom*

8:00 AM - 9:00 AM

Seminar 1 (Intermediate)

AI-Driven Alarms: Boosting BAS Controls with Instant ROI

Track: Artificial Intelligence, Building Automation and Controls

Room: Orlando VI

Sponsor: 1.4 Control Theory and Application, 7.5 Smart Building Systems , College of Fellows

Chair: Carol Lomonaco, Full Member, Carol Lomonaco - retired, Wauwatosa, WI

BAS control systems are often inundated with alarms that go unnoticed, leading to potential issues going unaddressed. Staff may overlook the thousands of alarms that accumulate week
after week, but what are the consequences of inaction? Are the same ten alarms triggering repeatedly, every few hours? This is where artificial intelligence comes into play, offering a
powerful solution to this pervasive problem. With today's AI technology, managing recurring alarms can be streamlined, providing immediate insights and solutions. This seminar explores the potential of AI in transforming BAS alarm management, showcasing successful AI-driven solutions to tackle these challenges head-on.

1. How to Categorize and Organize BAS Alarms for More Efficient Building Operations with a BAS Controls System in Hospitals

Edward Renshaw, PE*, Kaiser Permanente, San Diego, CA*

2. Successful Case Studies: Overwhelmed By BAS Alarms? Let AI Lead the Way

Frank Shadpour, Mechanical Engineer, ASHRAE Fellow, HFDP, Fellow Life Member*, SC Engineers, Inc., San Diego, CA*

8:00 AM - 9:00 AM

Seminar 2 (Basic)

ASHRAE Conference Crash Course

Track: Fundamentals and Applications

Room: Orange A

Sponsor: YEA Committee

Chair: Zachary Alderman, PE, Full Member, Cambio AI, Fayetteville, AR
First time at an ASHRAE Conference? Been coming for years, but still confused? What is a TC? What is a Standing Committee? Who can attend what? What is the AHR Expo? And why is all this happening at once? This crash course provides all attendees with an introduction to all the ASHRAE Conference activities, explains how you can get involved, and allows you to ask questions to experienced attendees.

1. The Ins and Outs of ASHRAE
***Blake Forsythe, Associate**, Hobbs & Associates, Inc.*
2. Getting Technical: An Overview of ASHRAE's Technical Offerings
***Chris Krieps, PE, Member**, Tesla, Austin, TX*
3. Make the Most of Your Conference Experience
***Vineet Nair, P.E., CHD, Full Member**, Sarepta Therapeutics, PROSPECT, KY, United States*

8:00 AM - 9:00 AM
Seminar 3 (Intermediate)

Cooling in Tune: Elastocaloric Cooling

Track: Fundamentals and Applications
NY PDH G
Room: Orange B
Sponsor: 1.1 Thermodynamics and Psychrometrics
Chair: Omar A Abdelaziz, PhD, Full Member, The American University in Cairo, Agouzah, Egypt
The escalating urgency to mitigate climate change necessitates innovative and sustainable cooling solutions. This seminar delves into elastocaloric cooling, a technology poised to revolutionize HVAC&R. Attendees will gain a comprehensive understanding of the latest advancements in elastocaloric materials, prototype development, and system performance.
Experts present on the performance metrics, energy efficiency and durability of elastocaloric materials and systems. By examining the trade-offs between coefficient of performance, capacity and fatigue, this seminar provides valuable insights into the technology's potential for real-world applications. Additionally, attendees will learn about the projected energy savings and emissions reductions achievable through its widespread adoption.

1. What Are the New Developments for Elastocaloric Cooling?
***Yunho Hwang, PhD, Fellow Member**, University of Maryland, College Park, MD*
2. Advances in Compression Based Elastocaloric Heat Pump Systems and Materials for Alternative Cooling Technologies
***Richard Blackburn, Eur.Ing.**., Exergyn, Dublin, Ireland*

8:00 AM - 9:00 AM
Seminar 4 (Intermediate)

Decarbonizing at Scale: Strategies for a Sustainable Energy Future

Track: Pathways to Building Decarbonization
NY PDH G
Room: Orange C
Sponsor: 2.5 Global Climate Change, 6.10 Fuels and Combustion
Chair: Daniel L. Villa, PE, Full Member, Sandia National Laboratories, ALBUQUERQUE, NM
This seminar features two distinguished speakers exploring cutting-edge decarbonization approaches. First, we learn about the complexities of large-scale decarbonization and the role of renewable fuels, hybridization and distributed carbon capture technologies. Our second speaker introduces his ambitious project to create a net-zero community that provides clean, affordable and reliable energy by integrating an eclectic mixture of trash-to-energy systems, solar panels, hydrogen electrolysis, anaerobic digestion and battery storage other technologies into a model for our net-zero future. This session highlights innovative solutions for a sustainable energy future.
1. Bridging the Clean Energy Gap: Exploring a Varied Path for Decarbonization
***Alex Fridlyand, Ph.D., Associate**, Gas Technology Institute, DAVIS, CA, United States*
2. Building America's First Net-Zero Carbon Community
***Joseph D'Ascenzo**, ReFined Plastics, King of Prussia, PA*

8:00 AM - 9:00 AM

Seminar 5 (Basic)

LIVESTREAM: Practical Progression and Implementation to Decarbonization

Track: Pathways to Building Decarbonization

Room: Orlando V

Sponsor: 7.3 Operation, Maintenance and Cost Management, 7.1 Integrated Building Design

Chair: Sonya M Pouncy, CEM, LEED AP, Full Member, Building Vitals, Detroit, MI

Three perspectives on how to approach decarbonization in existing facilities: planning, digitizing and categorization/organization. This seminar first explores how to approach aging infrastructure without losing sight of the need to decarbonize. This then looks at the role digitization, specifically a digital twin with analytics can play in decarbonization and overall operational efficiencies. Finally, this session discusses the roles of standard systems of information management and data tautologies on streamlining and decarbonizing operations.

1. Developing a Long Term Strategy and Decarbonization Plan
Aaron Sorrell, Full Member*, Federal Reserve Bank of Boston , BOSTON, MA*

2. Operational Impacts of Digitization and Digital Twins on Decarbonization Efforts
Daniel Michael Kolimar*, NV5, Irvine, CA*

3. The Relationship between BIM, Cobie and Sustainable Buildings
Arizona Oxendine, Director*, VDCO Tech, Easley, SC*

Sunday, February 9, 9:45 AM - 10:45 AM

Paper Session 4

Improving the Building Envelope

Track: Fundamentals and Applications

Room: Orange G

Chair: Mahroo Eftekhari, CEng, Full Member, Loughborough University, GB-Loughborough, Leicestershire, United Kingdom

This session explores cutting-edge advancements in AI-driven building technologies, including parametric thermal performance optimization for 3D-printed concrete walls, the Hydronic Shell retrofit system for scalable, low-carbon building electrification, and innovative solutions to minimize thermal bridging in prefabricated wall systems.

1. Parametric Simulation of the Thermal Performance of 3DCP Walls (OR-25-C010)
Armin Khazaei, Student[1]*, Zhihong Pang, Assistant Professor, Associate*[2]*, Yen-Fang Su, Assistant Professor*[1] *and Fan Feng, Postdoctoral Research Associate, Student*[3]*, (1)Louisiana State University, BATON ROUGE, LA, (2)Louisiana State University , BATON ROUGE, LA, (3)Pacific Northwest National Laboratory, Richland, WA*

2. Evaluation of a Prototype Hydronic Shell Integrated Envelope and Mechanical Solution (OR-25-C011)
Jason J LaFleur, Full Member[1]*, David J Goldstein, Professional Engineer, Full Member*[2] *and Ken D Hultquist, Associate*[1]*, (1)GTI Energy, Des Plaines, IL, (2)Hydronic Shell Technologies, Long Island City, NY*

3. Improving Thermal Performance of Prefabricated Wall Systems By Minimizing Thermal Bridging of Steel Brackets and Connectors with Minimal Investment Cost (OR-25-C012)
Hevar Jamal Palani, Student[1]*, Mikael H Salonvaara, Senior R&D Staff, Full Member*[2] *and Aslihan Karatas, Associate*[1]*, (1)University of Illinois Chicago, Chicago, IL, (2)Oak Ridge National Laboratory, OAK RIDGE, TN*

9:45 AM - 10:45 AM

Seminar 6 (Intermediate)

Applying Trusted Fundamentals to Address Our Changing Climate through New Technology and Vernacular Architecture Applications

Track: Fundamentals and Applications

Room: Orlando VI

Sponsor: 2.5 Global Climate Change, 2.8 Building Environmental Impacts and Sustainability , College of Fellows

Chair: Carol Lomonaco, Full Member, Carol Lomonaco - retired, Wauwatosa, WI

ASHRAE's position document on Climate Change states that "Climate change is the most formidable environmental challenge ever faced by society." Global temperatures are rising to dangerous levels. Our HVAC&R industry must step up by applying

HVAC&R fundamentals and applications, but with a new paradigm for increasing sustainability and good Indoor Environmental Quality (IEQ) while providing safety, comfort and resiliency. This seminar looks at new technology as well as borrowing strategies traditionally used in very hot climates to provide acceptable IEQ in an increasingly hotter world.

1. Isothermal Compression for Hotter Climate
***Yunho Hwang, PhD, Fellow Member**, University of Maryland/Department of Mechanical Eng, College Park, MD*

2. Designing Building Comfort Systems for Unprecedented High Temperatures Using Passive Principles of Vernacular Architecture in Historically Extremely Hot Climates
***Janice K Means, PE, Fellow Life S-B-a Member**, Retired from Lawrence Technological University, Southfield, MI*

9:45 AM - 10:45 AM

Seminar 7 (Intermediate)

Cutting-Edge Japanese Technologies on Advanced Industrialized Construction: Opportunities and Challenges: SHASE Annual Award Winners

Track: Industrialized Construction: Opportunities and Challenges

Room: Orange A
Chair: Ryozo Ooka, PhD, Fellow Member, IIS University of Tokyo, Tokyo, Japan
The SHASE Technology Award for Advanced Industrialized Construction is presented. First, a Fan-Powered Terminal Unit (FPTU) is developed to reduce both the workload and energy consumption of the air distribution system. Shape optimization and prefabrication of outlet chambers reduced on-site work, while digital technology such as RFID tags, BIM and head-mounted display reduced management work. Second, in order to reduce CO2 emissions throughout the lifecycle of a small building, a detailed BIM model was built from the initial stages, and a shared platform was established that could be used throughout the entire process, from design to construction and operation.

1. Reduction of Workload for HVAC Duct System in Japan By the Development of Fan Powered Terminal Unit System
***Naoki Onishi**, KAJIMA CORPORATION, Tokyo, Japan*

2. Digital Fabrication of Pipes and Ducts Using BIM in Small-Scale Projects
***Yoshinao Sato**, Takenaka Corporation, Hiroshima, Japan*

9:45 AM - 10:45 AM

Seminar 8 (Intermediate)

Earth, Heat and Ice: Expanding the Effectiveness of Geothermal Systems Using Ice Storage

Track: Energy Storage and Grid Resiliency

Room: Orange B
Sponsor: 6.8 Geothermal Heat Pump and Energy Recovery Applications
Chair: John Tesh, CHA Consulting, Colonie, NY
Ground source heat pumps (geothermal) are the most efficient form of electrified heating but are also the most expensive and require the most space. Through the application of ice storage, the capacity of geothermal systems to provide cooling and heating can be extended and the required size reduced. This seminar highlights systems that are both in use and in design that use ice storage in novel ways to expand system capacity, increase installed cost effectiveness and provide a wider operating envelope than they would otherwise have.

1. Thermal Ice Storage in Hybrid Geothermal System
***Brendan Hall, PE, BEMP, Full Member**, CHA Consulting, Syracuse, NY*

2. Ghx Peak Load Reduction with Ice Storage
***Ed Lohrenz, Associate Member**, GEOptimize Inc., Winnipeg, MB, Canada*

3. Retrofit Project with Storage-Source Heat Pump System
***John Michael Filler Jr, PE, HBDP, Full Member**, Trane Technologies, Colorado Springs, CO*

9:45 AM - 10:45 AM

Seminar 9 (Intermediate)

LIVESTREAM: HVAC Applications for Oil, Gas and Hydrogen Energy Production Facilities

Track: HVAC&R Systems and Equipment

Room: Orlando V

Sponsor: 9.2 Industrial Air Conditioning and Ventilation

Chair: Erich Binder, REYT CRM, Life Member, Erich Binder Consulting Limited, Calgary, ON, Canada

HVAC systems are crucial in the design of Oil, Gas, and Hydrogen production facilities. HVAC systems are required to provide safe and reliable operating environments for people and equipment. HVAC systems for onshore and offshore facilities must comply with site specific codes and requirements and must be carefully selected to meet the demands of harsh environments in which they operate. Maintenance activities and intervals are based on the criticality of the HVAC system, with bespoke equipment often being fabricated by specialist contractors. ISO 15138 is being revised to clarify and update HVAC design guidance for energy industry application.

1. Codes, Standards and Design Requirements Oil, Gas and Hydrogen Energy Production Facilities

Erik R Ostberg, PE, Full Member[1], ***Georgios Gournaras***[2] *and* ***Fabrice Laurent Deldreve***[3], *(1)BP America, Bellingham, WA, (2)Novenco, Trollåsen, Norway, (3)TotalEnergies, Paris, France*

9:45 AM - 10:45 AM

Seminar 10 (Intermediate)

Making Model Predictive Control Accessible: All the Benefits without the Cost or Complexity

Track: Artificial Intelligence, Building Automation and Controls

Room: Orange E

Sponsor: 1.4 Control Theory and Application

Chair: Paul W Ehrlich, Full Member, Building Intelligence Group LLC, Afton, MN

Model Predictive Control has many benefits for grid-connected buildings, including more accurate control, and the ability to forecast future building conditions. But building, testing, and deploying models is too expensive and complicated. This seminar focuses on a project called Differentiable Predictive Control, that is using ML to build and test models using building trend data and physics. The project is funded by the US Department of Energy and is working with control providers to test and validate the process.

1. Differential Programming for Model Predictive Control

Draguna Vrabie*, Pacific Northwest National Laboratory, West Richland, WA*

2. Living at the Center of Building Machine Interfaces

Layne A Clemen, Associate*, Elexity.io*

3. Putting the Pieces Together: Predictive Control, Semantic Interoperability and Applications

Jayson F Bursill, Ph.D, P.Eng., S-B-a Member*, Delta Controls Inc., Gloucester, ON, Canada*

9:45 AM - 10:45 AM

Forum 1 (Intermediate)

Is Building Performance Standard Legislation a Pathway to Decarbonization?

Track: Pathways to Building Decarbonization

Room: Orange F

Sponsor: 7.6 Building Energy Performance

Chair: Christine Reinders-Caron, Full Member, Iowa State University, Des Moines, IA

Cities, states and countries are all approaching the climate challenge differently. We are seeing various approaches to policies in energy performance monitoring, audit laws, and benchmarking. Some municipalities have adopted mandatory energy benchmarking while others have not. What policies are you seeing in your area? What success stories do you have to share? What

challenges are you facing? Join this forum for an open discussion regarding audit practices, benchmarking, and building performance standards and policies.

9:45 AM - 10:45 AM

Workshop 1 (Intermediate)

Energy-Efficient Buildings Connection to Integrated Power and Thermal Grids to Achieve Decarbonization Goals: Part 1

Track: Pathways to Building Decarbonization

G

Room: Orange C

Sponsor: 7.6 Building Energy Performance, Federal Buildings WG

Chair: Alexander M Zhivov, PhD,, Fellow Life Member, USACE, Champaign, IL

This workshop will be focused on technical and business strategies for climate change mitigation through decarbonization of energy supply to buildings, that are also supporting energy systems resilience, energy supply security and energy cost mitigation. The workshop discusses strategies for improvement of energy efficiency of building campuses, integration of power and thermal networks connected to buildings using mature and underutilized technologies, e.g., CHP, long term thermal storage, heat pumps, absorption chillers, etc., with examples of best practices.

1. Existing Buildings: Building Envelope & HVAC
***Steven Tratt, Architect, BCxP, Member**, WTI | Pure Air Control Services, Clearwater, FL*

2. Long-Term Transformation Strategies for Energy Systems for Energy Systems with Respect to Current Energy Challenges
***Alexander M Zhivov, PhD,, Fellow Life Member**, USACE, Champaign, IL*

3. Deep Energy Retrofits Best Practices in Federal Facilities
***John Anthony Kliem, PE, CE<**, Johnson Controls, York, PA*

Sunday, February 9, 11:00 AM - 12:30 PM

Paper Session 5

Advancements in Retrofit Analysis

Track: Fundamentals and Applications

NY PDH G

Room: Orange E

Chair: Aslihan Karatas, Associate, University of Illinois Chicago, Chicago, IL

This session explores cutting-edge advancements in retrofit analysis, including AI-enhanced air leakage detection, data-driven calibration of building energy models, prefabricated envelope retrofits, innovative non-destructive assessment tools, and future-proof retrofit strategies using machine learning and climate forecasting.

1. AI-Assisted Building Envelope Air Leakage Detection Using Transient Infrared Thermal Imaging (OR-25-C013)
***Zhenglai Shen, R&D Associate Staff, Associate**[1], Tianli Feng[2], Janak Tiwari[2], Philip Boudreaux, Associate[3], Som S Shrestha, Fellow Member[1] and Diana Hun[3], (1)Oak Ridge National Laboratory, OAK RIDGE, TN, (2)University of Utah, Salt Lake City, UT, (3)ORNL, Oak Ridge, TN*

2. Calibration of Building Energy Model Incorporating Occupant Behavior for Retrofit Analysis (OR-25-C014)
***Pratik Raj Pandey, Student**[1], Nina Wilson, PhD[1] and Bing Dong, Ph.D., S-B-a Member[2], (1)Syracuse University, Syracuse, NY, (2)Syracuse University, SYRACUSE, NY*

3. A Review of Prefabricated Overclad Panels for Building Energy Retrofits (OR-25-C015)
*Nolan Wesley Hayes[1], Diana Hun[1] and **Mengjia Tang, Full Member**[2], (1)Oak Ridge National Laboratory, Oak Ridge, TN, (2)Oak Ridge National Laboratory, OAK RIDGE, TN*

4. Development of Novel Techniques for Non-Invasive Air Leakage and Moisture Detection in Building Envelopes (OR-25-C016)
***Philip Boudreaux, Associate**, Stephen Killough, Rui Zhang, Associate, Gurneesh Jatana, William Partridge, Mark Root, Gina Accawi and Diana Hun, Oak Ridge National Laboratory, OAK RIDGE, TN*

11:00 AM - 12:30 PM

Paper Session 6

Multi-Building Analysis

Track: Fundamentals and Applications

Room: Orange F

Chair: Stephanie Kunkel, PE, Full Member, JMT, COCKEYSVILLE, MD, United States

This session highlights the data-driven approaches and renewable energy solutions in creating resilient and efficient urban infrastructures. Each topic addresses the impact of human behavior, climate change, and technological innovations on building energy usage and district heating systems.

1. City Agent: An Integrated Tool for Generating Synthetic Populations and Modeling Human Behavior in Urban Simulations (OR-25-C018)

Mohamed Osman, Student *and Mohamed Ouf, Associate, Concordia University, Montreal, QC, Canada*

2. Using Time Series Transformer Model for Sequence Forecasting of Heat Demand in District Heating Systems (OR-25-C019)

Marko Ignjatovic and ***Milan Zdravković****, Faculty of Mechanical Engineering, University of Niš, Niš, Serbia*

3. Thermal and Electrical Load Optimization in Building Clusters for Energy Flexibility in Grid Interaction (OR-25-C020)

Anthony Maturo, Student[1]*, Benoit Delcroix, Ph.D.*[2]*, Annamaria Buonomano, Ph.D.*[3] *and Andreas K Athienitis, Ph.D., P.E., Fellow Life Member*[4]*, (1)Concordia University, Montreal, QC, Canada, (2)Hydro-Québec Research Centre, Laboratoire des Technologies de l'Energie (LTE), Shawinigan, QC, Canada, (3)University of Naples - Federico II, Naples, Italy, (4)Concordia University Dept Of Bldg Civil, Montreal, QC, Canada*

4. Optimizing the Integration of Booster Heat Pump with Solar Thermal Collectors and Low-Temperature District Heating System in the Baltic Region: Laboratory Measurements (OR-25-C021)

Raimonds Bogdanovics, Mg. Sc. Ing., Student*, Jurgis Zemitis, Dr. Sc. Ing., Aleksandrs Zajacs, Dr. Sc. Ing. and Anatolijs Borodinecs, Dr. Sc. Ing., Full Member, Riga Technical University, Latvia, Latvia*

11:00 AM - 12:30 PM

Paper Session 7

What's Happening?: Field and Case Studies

Track: Fundamentals and Applications

Room: Orange G

Chair: Rachel L Romero, PE, Full Member, NREL, LAKEWOOD, CO, United States

Energy nowadays is the key word for sustainable future, this session explores energy efficiency throughout multiple field and case studies.

1. Net Zero Ready Multi-Family Buildings: How Are We Doing? (OR-25-C023)

Lois B Arena, PE, Full Member*, Steven Winter Associates Inc, Norwalk, CT*

2. Investigating the Variation of Energy Efficiency in K-12 School Buildings: A Case Study in Louisiana (OR-25-C024)

Armin Khazaei, Student[1]*, Fatemeh Ghafari*[1]*, Zhihong Pang, Assistant Professor, Associate*[2]*, Chao Wang, Associate Professor*[1] *and Michael Hayes, Assistant Professor*[1]*, (1)Louisiana State University, BATON ROUGE, LA, (2)Louisiana State University , BATON ROUGE, LA*

3. Prevalence of Mold Exposure in Rural Alaskan Housing (OR-25-C025)

Zoe Linko, Student[1]*, Janie Cooper, Student Member*[2]*, Cassandra Calliope Conrad*[2]*, Jordan Jacques*[2] *and Kristen Sara Cetin, PE, Full Member*[2]*, (1)Michigan State University, EAST LANSING, MI, (2)Michigan State University, East Lansing, MI*

4. A Field Study of Applying Data-Driven Multi-Zone Slab Temperature Prediction Model to Minimize Ground Source Heat Pump Standby Power (OR-25-C026)

SungHwan Lim, Student[1] *and Ali Malkawi*[2]*, (1)Harvard University, CAMBRIDGE, MA, (2)Harvard Center for Green Buildings and Cities, Cambridge, MA*

5. Analysis of Energy-Saving Opportunities in Two Large Public High Schools (OR-25-C027)

Charlie F Renze, High School Student, Student[1]*,* ***Daniel Ohadi, High School Student***[2]*, Shwe Htet Htet Htet Htet Aung, Student, Student*[3]*, Felipe De Castro*[3]*,* ***Michael Ohadi, Fellow ASHRAE***[3] *and Hugh Bruck, Ph.D.*[3]*, (1)Eleanor Roosevelt High School, Greenbelt, MD, (2)River Hill High School, Clarksville, MD, (3)University of Maryland, College Park, MD*

11:00 AM - 12:30 PM

Seminar 11 (Intermediate)

LIVESTREAM: Advances in AI Technologies for the Buildings Industry

Track: Artificial Intelligence, Building Automation and Controls

Room: Orlando V

Sponsor: 4.7 Energy Calculations , TC 7.10 (former MTG.OBB) and MTG.GenAI

Chair: Tianzhen Hong, PE, Fellow Member, Lawrence Berkeley National Laboratory, Berkeley, CA

With the growing volume of data, affordable cloud computing and advances in AI and machine learning technologies, there is an unprecedented opportunity to unlock such technologies' potential for the building industry to understand the dynamic energy use patterns under varying occupancy level, energy efficiency, demand flexibility, climate resilience, and occupant comfort and well-being. This seminar presents several examples of how AI has been used to provide insights for stakeholders to meet their energy and climate goals. Challenges and opportunities in unlocking generative AI for HVAC applications will also be discussed.

1. Streamline Semantic Data Model Creation for Building Applications Using Generative AI Techniques
***Han Li, Associate**, Lawrence Berkeley National Lab, BERKELEY, CA*

2. Explore Machine Learning Methods in Improving Occupancy Detection Based on Fusion of Sensor Dataset
***YI WU, Student Member**, Tsinghua University, Nanjing, China*

3. Automate Building Energy Model Generation with Large Language Models: From Prompt Engineering to Agentic Workflow
***Liang Zhang, Assistant Professor, Associate**, The University of Arizona, Tucson, AZ*

4. Streamlining Documentation Processes Using Large Language Models and Retrieval-Augmented Generation
***Hanlong Wan, Ph.D., Associate**, Pacific Northwest National Laboratory, Richland, WA*

11:00 AM - 12:30 PM

Seminar 12 (Advanced)

Indoor Environmental Quality in Schools Part 1: Thermal, Visual, Acoustic and Air Quality

Track: Ventilation and Indoor Environmental Quality

Room: Orlando VI

Sponsor: 4.10 Indoor Environmental Modeling, 2.1 Physiology and Human Environment , TC 9.7 Educational Facilities

Chair: Athanasios Tzempelikos, PhD, Full Member, Purdue University - Civil Engineering, West Lafayette, IN

This seminar presents new insights on assessment and prediction of Indoor Environmental Quality (IEQ) in educational buildings. The four presentations covers (i) the experimental assessment of all aspects of IEQ (thermal, visual, acoustic, air quality) in hundreds of classrooms (surveys, questionnaires, measurements) (ii) the efficiency of sensation, comfort and preference questions when predicting students' satisfaction with indoor environment (iii) within- and cross-domain effects of IEQ perception and (iv) air quality assessment and recommendations in classrooms.

1. Experimental Assessment of IEQ in Classrooms: Lessons and Findings
***Andrea Gasparella, Professor**, Faculty of Science and Technology, Free University of Bolzano, Bolzano, Italy*

2. Students' Satisfaction with Indoor Environment: Comfort or Preference?
***Athanasios Tzempelikos, PhD, Full Member**, Purdue University - Civil Engineering, West Lafayette, IN*

3. Within- and Cross-Domain Effects of IEQ Perception in Classrooms
***Francesca Cappelletti, Associate Professor, Associate**, University IUAV of Venice, Venice, Italy*

4. Air Quality Assessment and Recommendations in Classrooms
***Brian Harold Magnuson, Student**[1] and Brandon Emil Boor, Associate Professor, Associate[2], (1)Purdue University, W LAFAYETTE, IN, (2)Purdue University, West Lafayette, IN*

11:00 AM - 12:30 PM

Seminar 13 (Advanced)

Low and Ultra-low GWP Refrigerants and Equipment to comply with Current and Future Decarbonization Efforts

Track: Refrigeration and Refrigerants

Room: Orange A

Sponsor: 3.1 Refrigerants and Secondary Coolants, MTG.LowGWP Lower Global Warming Potential Alternative Refrigerants , Refrigeration Committee Technology Committee for Comfort, Process, and the Cold Chain (REF-CPCC)

Chair: Samuel F Yana-Motta, Full Member, Oak Ridge National Laboratory, Oak Ridge, TN

This seminar provides recent innovations/developments regarding low and ultra-low GWP refrigerants. This includes both natural and synthetic refrigerant options, and their main applications (air conditioning, refrigeration, heat pumps). The presenters include lead experts from the US and Europe. The intent is to discuss pathways to fulfill US and global efforts to decarbonization of building technologies.

1. Impact on Decarbonization Employing Ultra Low GWP (<10) for Unitary Equipment
***Stephen Kujak, Full Member**, Trane, La Crosse, WI*

2. Achieve Decarbonization with New System Architecture and Sustainable Refrigerants
***Kaimi Gao, Associate**, Honeywell, MINNEAPOLIS, MN*

3. Meet Tomorrow's Decarbonization Goals Using Today's Innovative Low GWP Refrigerants
***Mary E Koban, Full Member** and Joshua Hughes, Full Member, Chemours, LANDENBERG, PA*

4. Low GWP Refrigerants Dual Safety Classification: Code Compliant Methods for Safe Design
***Chris Seeton, Dr, Member**, Koura, The Woodlands, TX*

5. Low GWP Technologies from a European Perspective
***Asbjorn Leth Vonsild, M.Sc., Full Member**, Vonsild Consulting, Vejle, Denmark*

11:00 AM - 12:30 PM

Seminar 14 (Intermediate)

New Standards, Guidelines or Regulations for Ventilation due to COVID-19

Track: Ventilation and Indoor Environmental Quality

Room: Orange B

Sponsor: 4.3 Ventilation Requirements and Infiltration, AASA (ASHRAE Associate Societies Alliance

Chair: Bjarne Wilkens Olesen, Professor, Presidential Fellow Life Member, Intl. Center for Indoor Environment and Energy, DTUgy, Technical University of Denmark, Lyngby, NY, Denmark

There have been many activities worldwide during and after the COVID-19 pandemic to develop guidelines, standards or new regulations to decrease the risk of cross contamination in the indoor environment. Especially after it had been documented that ventilation plays a significant role in decreasing spreading, several organizations working with ventilation and the indoor environment have been active in leading research and distributing information. This seminar includes presentations of new guidelines, standards and regulations from North America, Europe and Asia

1. ASHRAE Standard 241-2023 – Control of Infectious Aerosols
***William P Bahnfleth, Ph.D., P.E., Presidential Fellow Life SBA Member**, The Pennsylvania State University, State College, PA*

2. An Overview of the Revision of Singapore Standards (SS553 and SS554) for Control of Infectious Aerosols in Buildings
***Chandra Sekhar, PhD, Fellow Member**, National University of Singapore, Singapore, Singapore*

3. A New System Adopted By Tokyo to Address the Threat of Infectious Diseases
***Kan Shindo, Associate**, Waseda University, Tokyo, Japan*

4. Revision of European Standard EN 16798-1: Ventilation Design for Airborne Transmission
***Jarek Kurnitski**, Tallinn University of Technology, Tallinn, Estonia*

11:00 AM - 12:30 PM

Workshop 2 (Intermediate)

Energy-Efficient Buildings Connection to Integrated Power and Thermal Grids to Achieve Decarbonization Goals: Part 2

Track: Pathways to Building Decarbonization

Room: Orange C

Sponsor: 7.6 Building Energy Performance, Federal BuildingsWG

Chair: Alexander M Zhivov, PhD,, Fellow Life Member, USACE, Champaign, IL

This workshop will be focused on technical and business strategies for climate change mitigation through decarbonization of energy supply to buildings, that are also supporting energy systems resilience, energy supply security and energy cost mitigation. The workshop will discuss strategies for improvement of energy efficiency of building campuses, integration of power and thermal networks connected to buildings using mature and underutilized technologies, e.g., CHP, long term thermal storage, heat pumps, absorption chillers, etc., with examples of best practices.

Presentation 1

Frank Santini, Attorney *and* ***Steven Tratt, Architect, BCxP, Member****, WTI | Pure Air Control Services, Clearwater, FL*

Presentation 2

Sreenidhi Krishnamoorthy, Ph.D., Associate*, Electric Power Research Institute, KNOXVILLE, TN*

Presentation 3

Robert P Thornton, Full Member*, International District Energy Association, Westborough, MA*

Presentation 4

Mogens Soendergaard Straarup, Civil Engineer, MBA*, COWI, Lyngby, Denmark*

Sunday, February 9, 1:30 PM - 3:00 PM

Paper Session 8

Enhancing Resiliency of Buildings

Track: Fundamentals and Applications

Room: Orange C

Chair: Aslihan Karatas, Associate, University of Illinois Chicago, Chicago, IL

This session examines the resilience and sustainability in the design and operation of building systems addressing specific challenges related to ventilation, HVAC systems, overheating risks, and the socioeconomic factors influencing healthcare and residential occupancy.

1. Optimizing Wildfire-Resilient and Sleep Health-Driven Mechanical Ventilation for Children's Hospitals (OR-25-C028)

Yalin Lu, Student[1]*, Ignacio E Tapia*[2] *and* ***Nan Ma, Affiliate***[1]*, (1)Worcester Polytechnic Institute, WORCESTER, MA, (2)University of Miami, Miami, FL*

2. Assessing Overheating Risk and Energy Impacts in California's Residential Buildings (OR-25-C029)

Harry Jiang, Master's Student, Student[1]*, Yan Wang, PhD*[2]*, Charlie Huizenga*[2]*, Carlos Duarte, Ph.D., Associate*[2]*, Paul Raftery, PhD, Full Member*[2]*, Stefano Schiavon, PhD, Full Member*[3] *and Gail S Brager, PhD, Fellow Member*[4]*, (1)University of California, Berkeley, BERKELEY, CA, (2)UC Berkeley, Center for the Built Environment, Berkeley, CA, (3)University of California Berkeley, BERKELEY, CA, (4)University of California, LOS ALAMOS, NM*

3. Analysis of Socioeconomic Factors Affecting Occupancy of Residential Buildings (OR-25-C030)

Jeonga Kang, Student[1]*, Patricia Guillante, Student*[2]*, Hao Dong, Student*[3] *and Kristen Sara Cetin, PE, Full Member*[3]*, (1)Michigan State University, East Lansing, MI, (2)Michigan State Univerisity, East Lansing, MI, (3)Michigan State University, EAST LANSING, MI*

4. Resilient and Sustainable Self Powered Heating System (OR-25-C032)

Sandeep Alavandi, Sr. Program Manager[1]*, Hamid Abbasi*[2]*, David Cygan*[2]*, John Wagner*[2]*, Joseph Pondo*[2] *and Vitaliy Gnatenko*[2]*, (1)GTI Energy, Des Plaines, IL, (2)GTI Energy*

1:30 PM - 3:00 PM

Paper Session 9

What's Happening?: Field and Case Studies 2

Track: Fundamentals and Applications

Room: Orange E

Chair: Amr Suliman, PhD, Full Member, University of Oxford, Loughborough, United Kingdom

This session presents diverse field studies and case analyses, including the implementation of occupancy-centric controls in office buildings, strategic applications of Section 179D for public decarbonization goals, efficiency trade-offs in Delhi Metro's chiller systems, energy benchmarking in Indian hospitals, and national energy-use insights from Indian airports.

1. How Smart Are European Buildings? (OR-25-C006)

Constantinos A Balaras, PhD, Fellow S-B-a Member[1], *Zois Asimakopoulos, Student Member*[2] *and Elena Dascalaki, Ph.D., Full Member*[1], *(1)Institute for Environmental Research & Sustainable Development, NOA, Athens, Greece, (2)Public Power Corporation S.A., Athens, Greece*

2. Long-Term Field Demonstration of Occupant Counting Sensors and Occupancy-Centric HVAC Controls in an Office Building (OR-25-C033)

Mingyue Guo, Student[1], *Zhihong Pang, Assistant Professor, Associate*[2], *Zheng O'Neill, Ph.D., P.E., Fellow Member*[3], *Blake Thomas Smith-Cortez*[4], *Zhiyao Yang, Ph.D., Associate*[1] *and Bing Dong, Ph.D., S-B-a Member*[5], *(1)Texas A&M University, COLLEGE STATION, TX, (2)Louisiana State University , BATON ROUGE, LA, (3)Texas A&M University , College Station, TX, (4)Texas A&M University Building Energy and HVAC&R Research Group, College Station, TX, (5)Syracuse University, SYRACUSE, NY*

3. Leveraging §179D Cash Value for Decarbonization: A Strategic Approach for Public and Non-Profit Entities (OR-25-C034)

Ruben Abreu, PE, CEM, LEED Green Associate, Full Member, *Kaizen Energy Consulting, Inc, Delray Beach, FL*

4. Analyzing Hospital Energy Performance: Insights and Lessons from India's National Hospital Energy Consumption Survey (OR-25-C036)

Satish Kumar, President & Executive Director, Fellow ASHRAE[1], *Akash Goenka, Associate Fellow*[1], *Sandeep Kachhawa, Expert - Cooling and Refrigeration*[1], *Meghaa Gangahar, Senior Research Associate*[1] *and Poornima Prabhakaran, Senior Research Scientist*[2], *(1)Alliance for an Energy Efficient Economy, New Delhi, India, (2)Centre for Chronic Disease Control, New Delhi, India*

5. Leading the Way in Airport Decarbonisation: Insights from Nation-Wide Airport Terminal Buildings' Energy Benchmarking in India (OR-25-C037)

Alisha Abraham, Senior Research Associate, Akash Goenka, Associate Fellow, Bhaskar Natarajan, Senior Fellow and ***Satish Kumar, President & Executive Director, Fellow ASHRAE****, Alliance for an Energy Efficient Economy, New Delhi, India*

1:30 PM - 3:00 PM

Paper Session 10

Advancing Mechanical Ventilation Requirements and Strategies

Track: Fundamentals and Applications

Room: Orange F

Chair: Samir R Traboulsi, Ph.D., P.Eng., Fellow Life Member, Thermotrade/Ranec, Beirut, Lebanon

This session presents the requirement and strategies of mechanical ventilation including studies comparing standards to real world results.

1. Designing Building Ventilation to Exceed Codes and Standards (OR-25-C038)

Kishor K Khankari, PhD, Fellow Member, *AnSight LLC, Ann Arbor, MI*

2. Numerical Study of CO_2 Concentration Control Methods in Ventilation Systems Considering Occupancy in Classroom (OR-25-C039)

Jeongan Park, Student, *Insoo Oh, Jinkyun Cho, Full Member, Beungyong Park, Member and Wonseok Oh, Hanbat National University, Deajeon, Korea, Republic of (South)*

3. Dedicated Clean Air Systems (DCAS) and Hybrid Ventilation for Sustainable and Low-Cost IAQ (OR-25-C040)

Benjamin Eli Goldberg, Application Engineer, Associate[1], *Hassan F Ali Younes, Co-CEO & Founder, BCxP, BEAP, BEMP, CHD, HBDP, HFDP and OPMP, Full Member*[2] *and Wyatt Ross, Associate Member*[3], *(1)enVerid Systems, Westwood, MA, (2)GRFN, Dubai, United Arab Emirates, (3)CMTA, Cincinnati, OH*

4. Assessing Indoor Air Quality in a Comparative Study Among ASHRAE Ventilation Standards Compared to A Control with a Continuous Active In-Room Air Cleaning Device (OR-25-C041)
Brett Duffy, EIT, Associate[1] *and* ***Margaret Scarlett, Dr.***[2]*, (1)CASPR Technologies, Mandeville, LA, (2)Scarlett Consulting, Atlanta, GA*

1:30 PM - 3:00 PM

Paper Session 11

Rejuvenating Refrigerants

Track: Fundamentals and Applications
Room: Orange G
Chair: David F Shipley, Full Member, Posterity Group, Ottawa, ON, Canada
This session explores cutting-edge approaches and technologies for enhancing energy efficiency and sustainability in refrigeration systems which focus on optimization, alternative refrigerants, and compliance with environmental standards.

1. Analysis and Validation of Genetic Programming for Circuitry Optimization (OR-25-C042)
Cheol-Hwan Kim, Ph.D.[1]*, Niccolo Giannetti, Dr. Eng.*[2]*, Yuichi Sei, Ph.D.*[3]*, Koji Enoki, Ph.D.*[2] *and Kiyoshi Saito, Dr.Eng, Affiliate*[4]*, (1)Research Institute for Science and Engineering, Waseda University, Tokyo, Japan, (2)Department of Mechanical and Intelligent Systems Engineering, The University of Electro-Communications, Tokyo, Japan, (3)Department of Informatics, The University of Electro-Communications, Tokyo, Japan, (4)Department of Applied Mechanics and Aerospace Engineering, Waseda University, Tokyo, Japan*

2. AIM Act Refrigerant Supply & Demand Modeling & Analysis (OR-25-C043)
Will Casey, Associate[1]*,* ***Michael May, Full Member***[2] *and Manny Garcia, Associate*[3]*, (1)Effecterra Inc., Reno, NV, (2)Effecterra Inc, Reno, NV, (3)Effecterra, Reno, NV*

3. Workflow for Assessing the Energy Efficiency of Refrigerating Systems Using Open-Source Software and an Evaluation Method Suggested in Specification Vdma 24247-7 (OR-25-C045)
Stefan Hudjetz, Researcher*, Daniel Pfeiffer, PhD student and Martin Becker, Professor, Biberach University of Applied Sciences, Biberach, Germany*

4. Experimental Study of the Thermodynamic and Operational Performance in a Refrigeration System Using R290 As a Replacement for R22 (OR-25-C046)
Hugo Francisco Zuniga Puebla, Ing, Student[1]*, E. Catalina Vallejo-Coral, MSc*[2] *and Carlos Naranjo-Mendoza Sr., PhD, Associate Member*[3]*, (1)Escuela Politecnica Nacional , Quito, Ecuador, (2)Instituto de Investigación Geológico y Energético, Quito, Ecuador, (3)Escuela Politecnica Nacional, Quito, Ecuador*

1:30 PM - 3:00 PM

Seminar 15 (Advanced)

LIVESTREAM: Implementation of Codes and Standard for Flammables in Field for Commercial Refrigeration

Track: Refrigeration and Refrigerants
NY PDH G
Room: Orlando V
Sponsor: 10.7 Commercial Food and Beverage Refrigeration Equipment, 10.6 Transport Refrigeration
Chair: Vishaldeep Sharma, Oak Ridge National Laboratory, Knoxville, TN
Flammable refrigerants have been gaining attention in the supermarket refrigeration industry due to their lower global warming potential (GWP). Their flammability characteristics pose new challenges for field implementations and require careful interpretation of current safety standards and practical field consideration. This seminar aims to have a deep dive discussion on field implementations of flammables (A2L, A3) in supermarket refrigeration.

1. Sustainability and Safety of A2L Refrigerant Implementation in Supermarket Refrigeration System
Doug Starasinic, Honeywell*, Honeywell International, Morris Plains, NJ*

2. Requirements for the Use of Flammable Refrigerants in Commercial Refrigeration Condensing Units
Roxanne M Scott, Full Member*, Copeland, Sidney, OH*

3. Partial Units with a Focus on Remote Display Cases and the Use of Flammable Refrigerant
Michael Chieffo, Full Member*, Zero Zone, North Prairie, WI*

4. A2L Implementation – Demonstration Case
Travis Cade Dingman Thompson, Associate*, DC Engineering Inc., Missoula, MT*

1:30 PM - 3:00 PM

Seminar 16 (Intermediate)

Innovative Technologies and Design Strategies for Achieving Greater Sufficiency and Resilience in Buildings

Track: Future-Proofing the Built Environment

Room: Orlando VI

Sponsor: 2.1 Physiology and Human Environment

Chair: Jeetika Malik, Research Scientist, Associate, Lawrence Berkeley National Laboratory, Berkeley, CA

This seminar focuses on innovative strategies to futureproof built environment, enhancing resilience and human well-being in the face of climate change. These talks cover innovative technologies and design strategies ranging from passive, low-energy active strategies to PV-battery systems and illustrate their effectiveness in maintaining safe indoor temperatures in residential communities at different spatial scales. Additionally, low-energy strategies for maintaining comfortable sleeping conditions during extreme temperatures will be presented. An international research initiative will also be highlighted, emphasizing the integration of human factors to enhance building resilience. These insights inform the stakeholders towards developing sustainable and resilient building solutions.

1. Evaluating Sufficiency and Resilience Potential of Cool Rooms within California's Underserved Communities
Jeetika Malik, Research Scientist, Associate*, Lawrence Berkeley National Laboratory, Berkeley, CA*

2. Optimal PV-Battery System Sizing Towards Future Climate Change: A Resilience and Sufficiency Perspective
Zixin Jiang, Student*, Syracuse University, SYRACUSE, NY*

4. District-Scale Cooling Resilience Improvement Based on Occupant Behavior-Integration Simulation
YI WU, Student Member[1] and ***Xuyuan Kang, Dr.***[2]*, (1)Tsinghua University, Nanjing, China, (2)School of Architecture, Tsinghua University, Beijing, China*

5. Human-Centric Buildings for a Changing Climate: A New International Research Network
Marianne Touchie, PhD, PEng, Full Member*, University of Toronto, Toronto, ON, Canada*

1:30 PM - 3:00 PM

Seminar 17 (Basic)

Student Projects to Document the Design, Construction and Operation of Thermal Energy Storage Systems

Track: Energy Storage and Grid Resiliency

Room: Orange A

Sponsor: 6.9 Thermal Storage

Chair: Daniel Pywell, PE, Member, Tanco Engineering, Loveland, CO

ASHRAE student chapters have shown great interest in Thermal Energy Storage systems with the new investment tax credits. What better learning experience is there for students than to review existing TES systems at their university or in their community and to document the design, construction and operation of different systems. ASHRAE Central Florida sponsored three student branches at University of Central Florida, Embry Riddle Aeronautical University, and Florida Institute of Technology.

1. Project 1 & 2
Valerie M. Hurst, Student *and* ***Jacob W. Owen, Student, Student****, Embry Riddle Aeronautical University, Daytona, FL*

2. Project 3
Alex Larrivee*, Florida Insitute of Technology, Melbourne, FL*

3. ASHRAE Chapters Can Encourage Engineering Students to Embrace HVAC Projects
Bruce B Lindsay, PE, Life Member*, Trane Technologies, Melbourne, FL*

1:30 PM - 3:00 PM

Seminar 18 (Basic)

The True Value of Building Performance

Track: Future-Proofing the Built Environment

Room: Orange B
Sponsor: 7.6 Building Energy Performance , CIBSE ASHRAE Liaison Committee
Chair: Vince Arnold, UCL, London, United Kingdom
This seminar explores the critical intersection of building performance and investing for sustainability. The five expert speakers delve into key topics, including the importance of building performance data in sustainable investing, delivering ESG (Environmental, Social, Governance) goals through building performance optimization, strategies for improving health via building performance, holistic approaches to enhance overall building performance and reimagining high-performance buildings for a positive societal impact.

1. Improving Building Performance
***Thomas H Phoenix, PE, BEMP, Presidential Fellow Life Member**, Consultant, Greensboro, NC*
2. Improving the Building Performance of Healthcare Estates
***Mark Richard Walker, FCIBSE**, Hydrock/Stantec, Manchester, United Kingdom*
3. Delivering ESG through Building Performance Optimisation
***Edith Eileen Blennerhassett, FCIBSE, Full Member**, Arup, London, United Kingdom*
4. The Importance of Building Performance Data to Sustainable Investing
***Parag Cameron-Rastogi, PhD, CEng, MCIBSE, MASHRAE, Full Member**, GRESB, Glasgow, United Kingdom*
5. Building Performance Reimagined
***Anastasia Mylona, MCIBSE**, CIBSE, London, United Kingdom*

Sunday, February 9, 3:15 PM - 4:45 PM
Panel 1 (Intermediate)

Long Term Outlooks for the Built Environment

Track: Future-Proofing the Built Environment
Room: Orlando VI
Sponsor: 7.3 Operation, Maintenance and Cost Management , College of Fellows
Chair: Aaron Sorrell, Full Member, Federal Reserve Bank of Boston , BOSTON, MA
Many approaches to the future of the built environment have been proposed. This panel explores those options, and dives into the best approach(es) and the time frame to achieve them. The panel discussion includes net-zero, decarbonization, passive house and other options, as well as the time frame to execute them successfully.

1. Panelist 1
***Paul A Torcellini, P.E., Fellow Member**, NREL, LAKEWOOD, CO, United States*
2. Panelist 2
***Filza H Walters, MBA, FESD, FASHRAE, Fellow S-B-a Member**, Texas A&M University, COLLEGE STATION, TX*
3. Panelist 3
***Rajan U Rawal, PhD, Fellow ASHRAE**, CEPT University, Ahmedabad, Gujarat, India*
4. Panelist 4
***Satish Kumar, President & Executive Director, Fellow ASHRAE**, Alliance for an Energy Efficient Economy, New Delhi, India*
5. Panelist 5
***Stephen W Duda, PE, Fellow Member**, Southern Illinois University Edwardsville, Edwardsville, IL*

3:15 PM - 4:45 PM
Seminar 19 (Intermediate)

LIVESTREAM: Tax Credits for Thermal Storage Are Driving New Projects--How Do We Calculate Emissions, Measure Resiliency, and Certify for LEED, and What Are Utilities Doing?

Track: Energy Storage and Grid Resiliency

Room: Orlando V
Sponsor: 6.9 Thermal Storage
Chair: Bruce B Lindsay, PE, Life Member, Trane Technologies, Melbourne, FL

The Inflation Reduction Act provides a 40% tax credit for thermal storage systems, making a chilled water plant with storage the lowest cost option. Most projects are comparing conventional chillers to partial storage and full storage TES. 90.1 is proposing energy credits for TES. LEEDv5 addresses TES. Mission critical facilities are adding TES for resiliency. Tools are being developed to calculate GHG emissions for heating and cooling, and the impact of grid flexibility. Utilities are offering new rates to encourage smart charging of EVs and new rebates for electric batteries. Fasten your seatbelts!

1. TES and LEEDv5
***Ian L LaHiff, PE, LEED AP, Full Member**, US Green Building Council, Orlando, FL*

2. Analytic Tool to Assess Economics and Emissions of Thermal Storage for Heating and Cooling
***Scott Delo, PE, CEM, BEMP, BEMP, Full Member**, Trane Technologies, Melbourne, FL*

3. Resiliency of Thermal Energy Systems in Hot and Humid Regions
***Alexander M Zhivov, PhD,, Fellow Life Member**, US Army Engineer Research and Development Center, Champaign, IL*

Monday, February 10

Monday, February 10, 8:00 AM - 9:30 AM

Paper Session 12

A Little Bit of Everything (Poster Session)

Track: Fundamentals and Applications

NY PDH G

Room: Orange G
Chair: Subhrajit Chakraborty, P.E., Student, Davis, CA
Discover breakthroughs in building performance and energy systems. Studies include residential and commercial applications, calculation optimization, data collection methods, to building management practices. These insights propel sustainable building practices and enhance energy efficiency.

1. Opportunities for Improved Refrigerant Recovery: Experimental and Analytical Findings (OR-25-C047)
***Dennis Nasuta, Full Member**, Timothy Kim, James Carow, William Hoffman and Romeo Mpaga, OTS R&D, Inc., Beltsville, MD*

2. Benefits of Tankless Water Heaters for Large Capacity Applications (OR-25-C048)
***Patricia F Rowley, Associate**[1] and Abinesh Ravi, Principal Engineer, Associate Member[2], (1)GTI, DES PLAINES, IL, (2)GTI Energy, Des Plaines, IL*

3. Optimizing Energy Savings Calculations: A Comprehensive Approach to Measure Lifetime Estimation for Energy Conservation Measures (OR-25-C050)
***Charles Nii-Baah Amoo, Student**[1], Mini Malhotra, Ph.D.[2], Bill Eckman[2] and Joshua New, Ph.D., Full Member[3], (1)University of Tennessee Oak Ridge Innovation Institute, Knoxville, TN, (2)Oak Ridge National Laboratory, Oak Ridge, TN, (3)Oak Ridge National Laboratory, OAK RIDGE, TN*

4. Enhancing Building Energy and Water Management: Integrating Solar-Driven Reverse Osmosis with Insulated Concrete Form Thermal Storage (OR-25-C051)
***Amirhossein Eisapour, Student**, Mohammad Emamjome Kashan and Alan S. Fung, P.Eng, Member, Toronto Metropolitan University, Toronto, ON, Canada*

5. Experimental Evaluation of a Novel Wall-Embedded Micro Heat Pump for Radiant Heating in Buildings (OR-25-C052)
***Feng Wu, Student**[1], Changkuan Liang, Student[2], Sarah Alkandari, Student Member[3], Haotian Liu, Ph.D[3], James E Braun, Ph.D., Fellow Life Member[1], William Travis Horton, Ph.D.[4], Panagiota Karava, Ph.D., Associate Member[4] and Davide Ziviani, PhD, Full Member[3], (1)Purdue University, W LAFAYETTE, IN, (2)Purdue University - Herrick Labs, West Lafayette, IN, (3)Purdue University - Ray W. Herrick Laboratories, West Lafayette, IN, (4)Center for High Performance Buildings, Purdue University, West Lafayette, IN*

6. Energy Efficiency Performance Evaluation of Interior Sealing Materials for HVAC Ducts in Saudi Buildings (OR-25-C053)
***Ayman Youssef, PE, Full Member**[1] and Ahmed Ali Alzahrani, Eng, Associate[2], (1)C/O Saudi Aramco, Dhahran, Saudi Arabia, (2)Saudi Aramco, Dhahran, Saudi Arabia*

7. Remote Electricity and Oil Consumption Data Collection Using Lorawan Protocol and Sensors (OR-25-C054)
***Andrew Louis Compton, Student**[1], Quinn Raleigh[2], Will Bailey[2], Cassandra Calliope Conrad[2] and Kristen Sara Cetin, PE, Full Member[2], (1)Michigan State University, EAST LANSING, MI, (2)Michigan State University, East Lansing, MI*

8. Optimizing Residential Energy Use: Predictive Models for DX Air Conditioning Units (OR-25-C055)

***Khaled Naser Eid, Student**, University of Cincinnati, Cincinnati, OH*

8:00 AM - 9:30 AM

Paper Session 13

BIPV and Building Envelope Performance

Track: Fundamentals and Applications

Room: Orange E

Chair: Vikrant C Aute, Ph.D., Fellow Member, University of Maryland, COLLEGE PARK, MD

This session discusses how innovations in building envelope design and optimization can impact energy performance and building resilience. The discussions cover greenhouse rooftop, photovoltaic thermal system, insulation and envelope thermal mass.

1. Modeling and Accessing Optimal Design Strategies of a Modular Rooftop Greenhouse with a Building Integrated Photovoltaic System (OR-25-C056)
***Yearim Yang** and Andreas K Athienitis, Ph.D., P.E., Fellow Life Member, Concordia University Dept Of Bldg Civil, Montreal, QC, Canada*

2. A Multidisciplinary Framework for Building Integrated Photovoltaic/ Thermal (BIPV/T) System Adoption at the Early Design Stages (OR-25-C057)
***Anna-Maria Sigounis, Student**[1] and Andreas K Athienitis, Ph.D., P.E., Fellow Life Member[2], (1)Concordia University, Montreal, QC, Canada, (2)Concordia University Dept Of Bldg Civil, Montreal, QC, Canada*

3. Evaluation of the Thermal Resilience of Residential Buildings with PCM Enhanced Envelope Under Different Climate Zones (OR-25-C058)
***Youmin Xu, BEAP, Student**[1] and **Xu Han, PhD, Full Member**[2], (1)University of Kansas, Lawrence, KS, (2)University of Kansas, LAWRENCE, KS*

4. Exploring the Building Envelope Performance for Energy Usage in Extreme-Temperature Climates (OR-25-C059)
***Mina Lesan, Ph.D. student in Construction Management**, Saeid Chahardoli, Ph.D., Student and Arup Bhattacharya, Ph.D., Associate, Louisiana State University, Baton Rouge, LA*

5. Efficient Energy Simulation for Insulation Optimization in Carbon Negative Building Design (OR-25-C060)
***Yangxi Bai, PhD, Student** and Endong Wang, State University of New York (SUNY ESF), Syracuse, NY*

8:00 AM - 9:30 AM

Paper Session 14

Advancements in Air Filtration, Cleaning and Contaminant Analysis

Track: Fundamentals and Applications

Room: Orange F

Chair: Som S Shrestha, Fellow Member, Oak Ridge National Laboratory, OAK RIDGE, TN

Indoor air quality (IAQ) significantly impacts human health and cognitive performance. The influence of outdoor conditions, building airtightness, filtration, and human activity on IAQ is significant. The papers in this session focused on the removal of airborne ultrafine particles from HVAC fan operation, as well as the use of ionization technologies and methods to create a consistent particle source in controlled laboratory environments.

1. ASHRAE Standard 52.2 Performance and Recommendations (1784-RP) (OR-25-002)
***Kathleen Owen, Fellow Member**, Owen Air Filtration Consulting, Cary, NC*

2. Fate of Ultrafine Particles in HVAC Fan Operation Experiments in a Multiroom Residence (OR-25-C061)
***Daniel J Rush, Ph D Candidate, Student**, Sangyoung Hyun, Graduate Student and Atila Novoselac, PhD, S-B-a Associate, University of Texas at Austin, AUSTIN, TX*

3. Particle Generation Methods for Human Subject Testing in Controlled Laboratory Environments (OR-25-C062)
***Xin Guo, Mechanical & Aerospace Engineering, Student**[1], Tong Lin, Associate[1], Bing Guo[1] and Jianshun Zhang[2], (1)Syracuse University, SYRACUSE, NY, (2)Syracuse University, Syracuse, NY*

4. Utilizing the Euler Method for Modeling Ion-Particle Interactions (OR-25-C063)
***Wenfeng Huang, Student**[1], Tong Lin, Associate[2] and Jianshun Zhang[1], (1)Syracuse University, Syracuse, NY, (2)Syracuse University, SYRACUSE, NY*

5. Validation of Gas-Phase Air-Cleaner Performance Test Method (Standard 145.2) by Laboratory Testing of Commercially Available Filtration Devices (1720-RP) (OR-25-003)

***Kathleen Owen, Fellow Member**, Owen Air Filtration Consulting, Cary, NC*

8:00 AM - 9:30 AM

Seminar 20 (Intermediate)

Cutting-Edge Japanese HVAC&R Systems and Equipment: SHASE Annual Award Winners

Track: HVAC&R Systems and Equipment

Room: Orange A

Chair: Masayuki Ichinose, PhD, Full Member, Tokyo Metropolitan University, Tokyo, Japan

Three SHASE Annual Award-winning buildings featuring advanced HVAC&R Systems and Equipment are presented. The first is an office building that introduces the fluctuation ductless air-conditioning system with triple-nozzle module and an outdoor air treatment system that enables the reuse of restroom exhaust heat. The second is an office building that introduces an air-conditioning system that combines a thermo active building system and floor supply displacement air-conditioning system. The third is a commercial facility that introduces a dedicated outdoor air system by combining cascade use of chilled water and reheating coil using returned water and desiccant air-conditioning using solar heat.

1. Planning and Verification of Fluctuating, Ductless, Sharing HVAC and Use of Exhaust Heat from Restroom Adopted for a Medium-Scale Building
***Hajime Omomo**, SUGA Co.,Ltd, Tokyo, Japan*

2. Operation and Effectiveness Verification of an Air Conditioning System That Combines TABS and a Floor Supply Displacement Air Conditioning System
***Masato Narita**, Shimizu, Corp., Sendai, Japan*

8:00 AM - 9:30 AM

Seminar 21 (Intermediate)

Decarbonization of Cleanrooms through More Effective Determination of Air Change Rates

Track: Pathways to Building Decarbonization

Room: Orange B

Sponsor: 9.11 Clean Spaces, MTG.ACR Air Change Rate

Chair: Vincent A Sakraida, PE, LEED AP, Full Member, Olsson, Evansville, IN

Cleanrooms have the highest energy usage on a square foot basis than any other type of space. A major contributing factor is the high air change rates that were prescribed for cleanrooms, which are substantially higher than needed to meet the ISO 14644 particulate requirements.

This seminar looks at the establishing a method for calculating the necessary cleanroom air change rate. The seminar includes the impact of the presently used air change rates on the environment, a status on the TC9.11 Task Forces in developing an air change rate calculation and the impact on ventilation effectiveness.

1. Present Cleanroom Air Change Rate Impact on Global Energy Usage
***Conor Murray, BE (Elec) MIE, Full Member**, 3dimension Cleanrooms Limited, Baldoyle, Ireland*

2. TC9.11 Cleanroom Air Change Rate Task Force Update
***Vincent A Sakraida, PE, LEED AP, Full Member**, Olsson, Evansville, IN*

3. Impact Right Sizing Cleanroom Air Flow Has on Contamination Removal Effectiveness
***Kishor K Khankari, PhD, Fellow Member**, AnSight LLC, Ann Arbor, MI*

8:00 AM - 9:30 AM

Seminar 22 (Intermediate)

Developing a Carbon-Free Future Depends on Opening the Door to the Past: Existing Buildings Hold the Key

Track: Pathways to Building Decarbonization

Room: Orange C

Sponsor: MTG.EBO Effective Building Operations, 7.3 Operation, Maintenance and Cost Management , TC 1.4

Chair: Jennifer A Isenbeck, PE, Full Member, Moffitt Cancer Center, TAMPA, FL

To meet global decarbonization goals, keys to success will need to incorporate existing building stock (**75% of buildings in 2050 already exist**). Tools and resources are available for owners, engineers and invested stakeholders of existing buildings. Presentations focus on three different pathways that address energy efficiency, resource optimization, embodied carbon, policy and financing - all essential to decarbonization strategies. How can data, AI and building modeling impact capital and operating costs for infrastructure and equipment replacement?

1. 36066 - Decarbonization: ASHRAE Has Been Doing It All Along
Silvia S Tirado, Associate[1] *and Mina Agarabi, Full Member*[2]*, (1)Agarabi Engineering, Brooklyn, NY, (2)Agarabi Engineering, PLLC, Brooklyn, NY*

2. Using Data Analytics to Support Your Energy and Decarbonization Strategies
Sanjyot Bhusari*, Affiliated Engineers, Inc., Gainesville, FL*

3. Collaboration with Impact: Carbon Reduction Performance Contracting Challenge
Timothy D Unruh, Ph.D, P.E. CEM., LEED AP, Full Member*, NAESCO, Washington, DC*

8:00 AM - 9:30 AM

Seminar 23 (Intermediate)

Refrigerant, Refrigeration Trends and Compliance

Track: Refrigeration and Refrigerants

Room: Orlando VI

Sponsor: 10.2 Refrigeration Applications, 8.2 Centrifugal Machines , College of Fellows (Main Sponsors)

Chair: Tiffany Bates Abruzzo, Director of Engineering Sales, Full Member, Envirosep, GEORGETOWN, SC, United States

This seminar explores recent major changes in refrigerant governance and cutting-edge developments in refrigeration. Key topics include energy efficiency, environmentally friendly refrigerants and their impact on food preservation, medicine storage and building comfort. Industry experts discuss sustainable systems and cross-functional knowledge sharing, as well as regulatory compliance. Join us to stay at the forefront and deliver the systems, designs and components your clients will be requesting.

1. Refrigerant Changes – Wow!
Mick CA Schwedler, PE, Presidential Fellow Life Member*, Trane, SAN JUAN, PR*

2. Beyond Carbon: GHG Including Refrigerants Towards Zero
Luke C H Leung, PE, BEMP, Fellow Member*, Skidmore Owings & Merrill, CHICAGO, IL*

3. Ice-Based Refrigerants in Medium to Low Temperature Applications
Russell Goldfarbmuren, CTO/Co-founder of Rebound, Full Member*, Rebound, Denver, CO*

8:00 AM - 9:30 AM

Seminar 24 (Intermediate)

LIVESTREAM: The Killer Application: How New ASHRAE Standards Can Unleash Building Control Efficiency and Grid Support

Track: Artificial Intelligence, Building Automation and Controls

Room: Orlando V

Sponsor: 1.4 Control Theory and Application

Chair: Paul W Ehrlich, Full Member, Building Intelligence Group LLC, Afton, MN

A new generations of applications will enable building control systems to be optimized, find and fix faults and interact with the grid. These have the potential to dramatically improve energy efficiency, and support decarbonization. But they will require semantic information about the content of the building systems and controls.
Evolving ASHRAE standards including 223P and 231P will be able to provide this semantic information and models.
This session explores the benefits of having this information, the current "state of the art" in creating models from existing building systems, and future solutions to enable broad deployment.

1. Vision: What Will Become Possible with Open Building Control Information
***Paul W Ehrlich, Full Member**, Building Intelligence Group LLC, Afton, MN*

2. Pilot Demonstrations of Controls in Existing Buildings Using ASHRAE Standards 223P and 231P
***Anand Krishnan Prakash, Student**, Lawrence Berkeley National Laboratory, Berkeley, CA*

3. Leveraging ASHRAE Standard 223P, a Case Study in Enhancing Building Control and Analytics
***Parastoo Delgoshaei, Associate**, NIST, GAITHERSBURG, MD*

4. Future Tools and Solutions for Brownfield Deployment of Building Ontologies
***Gabe Fierro, Dr., Associate**, Colorado School of Mines, GOLDEN, CO*

Monday, February 10, 9:45 AM - 10:45 AM

Panel 2 (Basic)

Making Sense of the Alphabet Soup

Track: Fundamentals and Applications
Room: Orlando VI
Sponsor: 7.1 Integrated Building Design
Chair: Elyse M Malherek, Associate, Big Ladder Software, ANAHEIM, CA
It used to be that you could either design it or build it; or you could, sometimes, design and build it. But today, there is a blizzard and bevy of pathways and terms (TLAs?). Things can sometimes sound a bit circular and sometimes redundant. Terms like DBB, D-B, Design-Assist, IPD, D-BOT, D-BOM, Fast-Track, ultra Fast-Track, GMP, etc, etc. Coming up through the ranks, many of these terms are tossed around on projects, and no one takes time to explain them. Attend this panel to get the lowdown on the alphabet soup of ways to get projects done.

1. Contractor Perspective
***James A Arnold, PE, Full Member**, Gutridge, Dublin, OH*

2. Design Engineer Perspective
***Lianne Cockerton, P. Eng., Full Member**, Martin Roy et Associes, Deux-Montagnes, QC, Canada*

3. Legal Guru and Engineer Perspective
***Mitchell Swann, P.E., Life Member**, Resolution Management Consultants, Philadelphia, PA*

9:45 AM - 10:45 AM

Paper Session 15

HVAC&R Improvements (Poster Session)

Track: Fundamentals and Applications

NY PDH G

Room: Orange G
Chair: Songhao Wu, Associate, CMTA, Inc, W LAFAYETTE, IN
Indoor air quality (IAQ) significantly impacts human health and cognitive performance. The influence of outdoor conditions, building airtightness, filtration, and human activity on IAQ is significant. The papers in this session focused on the removal of airborne ultrafine particles from HVAC fan operation, as well as the use of ionization technologies and methods to create a consistent particle source in controlled laboratory environments.

1. Laminar Flow Radial Ceiling Fan a Study of It's Destratification and Significant HVAC Energy Reduction and Thermal Comfort (OR-25-C064)
***Richard W Halsall, CEO Exhale Fans LLC, Full Member**, Exhale Fans LLC, Georgetown, IN*

2. Added-Value for the Data from Chiller Units with AI Application (OR-25-C065)
***Bing-Chwen Yang, PhD, Full Member**[1], Hui-Jiunn Chen, air conditioning engineering, Life Member[2] and Chung-Kuan Kung, air conditioning engineering[3], (1)NYCU, Hsinchu, Taiwan, (2)Sound Air Industrial Co., Ltd., New Taipei City, Taiwan, (3)KYW Energy Tech Co., Ltd., New Taipei City, Taiwan*

3. Operating Temperature Optimization for a 5th Generation District Heating and Cooling Network Using Model Predictive Control (OR-25-C066)
***Yuhang Zhang, Student**[1], Mingzhe Liu, Ph.D., Student[1] and Zheng O'Neill, Ph.D., P.E., Fellow Member[2], (1)Texas A&M University, COLLEGE STATION, TX, (2)Texas A&M University , College Station, TX*

4. Optimization-Based Geometric Design of Desiccant Wheels (OR-25-C067)
***Hang Guan, Student**[1], Mingzhe Liu, Ph.D., Student[1], Zhiyao Yang, Ph.D., Associate[1] and Zheng O'Neill, Ph.D., P.E., Fellow Member[2], (1)Texas A&M University, College Station, TX, (2)Texas A&M University , College Station, TX*

5. Performance of a 3D Printed Heat Exchanger for an Indirect Evaporative Cooling System with Mist Generation (OR-25-C068)
*Dominic Meler and **Younggil Park, Associate**, Florida Polytechnic University, Lakeland, FL*

6. Advanced PVA/Mxenes/GO/PVDF Nanocomposite Membranes for Energy Efficient Heating, Ventilation, and Air Conditioning Systems (OR-25-C069)
***Setareh Heidari**, Maria Augusta Correa Martins, Babak Anasori and David Warsinger, Purdue University, West Lafayette, IN*

9:45 AM - 10:45 AM
Paper Session 16

Model Validation

Track: Fundamentals and Applications

NY PDH G

Room: Orange E
Chair: Matthew Davy, Full Member, Arup, London, MA, United Kingdom
Real-time model predictive control is adopted for grid-interactive and energy efficiency building operations. This session covers several studies that validate, apply and evaluate predictive models and methods.

1. Utilizing Real-Time Electrical Meter Data to Validate Predictive Energy Model Assumptions for a Hospital (OR-25-C070)
***Travis R English, P.E., Full Member**[1], **Sterling Rollyn Butler, Associate**[2], Murat Karakas, P.E.[2] and Rob Best[3], (1)Kaiser Permanente, FARMINGTON, CT, (2)Arup, Los Angeles, CA, (3)Arup, San Francisco, CA*

2. Development of an Inuit-Based Occupant Behavior Model By Adapting an Already Existing Model to the Arctic Conditions (OR-25-C071)
***Jean Rouleau, P.Eng., Ph.D., Student** and Louis Gosselin, P.Eng., Ph.D., S-B-a Member, Universite Laval, Quebec City, QC, Canada*

3. Impact of Building Characteristics on Energy Demand Profile Forecasting: An Evaluation of Predictive Accuracy and Methods (OR-25-C072)
***Shovan Chowdhury, Student**[1], Fengqi Li, Associate[2], Avery Stubbings[3] and Joshua New, Ph.D., Full Member[4], (1)University of Tennessee, KNOXVILLE, TN, (2)ORNL, Oak Ridge, TN, (3)Oak Ridge National Laboratory, Oak Ridge, TN, (4)Oak Ridge National Laboratory, OAK RIDGE, TN*

9:45 AM - 10:45 AM
Paper Session 17

Social Equity

Track: Fundamentals and Applications
Room: Orange F
Chair: Joy Eileen Altwies, PhD, Full Member, University of Wisconsin-Madison, Madison, WI
This session identifies particular barriers in achieving social equity in the HVAC&R industry. The first paper examines the influence of climate change and utility costs in residential energy consumption in Louisiana to guide future initiatives promoting social and energy equity. The second explores the current workforce in the refrigeration, air conditioning, and heat pumps sector, and identifies barriers that keep young people, specifically young women, from entering the industry. The third explores advancements in digitalization technologies to promote gender equity and inclusivity.

1. A Longitudinal Analysis of Residential Electricity Costs and Social Equity Implications in Louisiana (OR-25-C073)
*Avijit Sarker, Research Assistant, Student, **Leandro Pereira Pinheiro, Research Assistant, Student**, Zhechao Wang, Research Assistant, Student, Zhihong Pang, Assistant Professor, Associate and Chao Wang, Associate Professor, Louisiana State University, Baton Rouge, LA*

2. Women in North America in the Refrigeration, Air Conditioning, and Heat Pump Industry (OR-25-C074)
*Rebecca Dalphin[1], Colleen Keyworth[2], Ina Colombo, Associate[3], Monique Baha[3], Ana Catarina Almeida, PhD, Full Member[4] and **Yosr Allouche**[3], (1)Hamilton College, Clinton, NY, (2)Woman in HVACR, Phoenix, AZ, (3)International Institute of Refrigeration, Paris, France, (4)London South Bank University, London, United Kingdom*

9:45 AM - 10:45 AM
Seminar 25 (Advanced)

LIVESTREAM: Energy Storage Solutions to Enhance Building and Grid Resilience

Track: Energy Storage and Grid Resiliency

Room: Orlando V

Sponsor: 8.2 Centrifugal Machines, College of Fellows (Main Sponsors)

Chair: Tiffany Bates Abruzzo, Director of Engineering Sales, Full Member, Envirosep, GEORGETOWN, SC, United States

As building energy demands increase and extreme weather events and other disruptions to the electric grid become more frequent, engineers in the buildings industry play a crucial role in ensuring grid resilience. This seminar explores solutions such as microgrids, fly wheel scale and ice making for peak energy shedding as effective options for emergency management agencies, delving into technologies, policies, economics and case studies, emphasizing how these solutions enhance building and electricity grid resilience. Join us to learn about the latest advancements and strategies to bolster grid reliability and mitigate power outages during critical situations.

1. Buildings and Resilient Grids
***Sheila J Hayter, PE, Presidential Fellow Member**, National Renewable Energy Laboratory, WASHINGTON, DC*

2. Energy Storage Varieties
***Drew Scott Turner, Full Member**, Danfoss, Copenhagen, Denmark*

3. Ice Banking to Help the Grid
***Russell Goldfarbmuren, CTO/Co-founder of Rebound, Full Member**, Rebound, Denver, CO*

9:45 AM - 10:45 AM

Seminar 26 (Intermediate)

Overview of ASHRAE RP-1815: Integrating Occupant Behavior Data into Building Information Modeling for Performance Simulation

Track: Future-Proofing the Built Environment

Room: Orange A

Sponsor: 1.5 Computer Applications

Chair: Stephen B Roth, PE, Full Member, Carmel Software Corp, SAN RAFAEL, CA

This seminar includes a recap of our findings from ASHRAE RP-1815. The objective of this research project was to assess the representation and affect of building occupant behavior in Building Information Modeling (BIM) and Building Energy Modeling (BEM) workflows and develop proposals for implementation and adoption of data schema enhancements.
The first presentation gives an overview of building occupant behavior and how it affects building energy usage.
The second gives an overview of RP-1815 and will also discuss the updates to the gbXML schema.
The third discusses IFCs and the ontologies that were researched.

1. Advances in Modeling Occupant Behavior and Its Impact on Building Performance
***Tianzhen Hong, PE, Fellow Member**, LBNL, Berkeley, CA*

2. Overview of ASHRAE RP-1815 and Proposed Schema Updates
***Stephen B Roth, PE, Full Member**, Carmel Software Corp, SAN RAFAEL, CA*

3. Integrated Occupant Behavior Modeling Data into BIM to Building Energy Modeling Workflows
***Dennis Shelden, Full Member**, RPI, Brooklyn, NY*

9:45 AM - 10:45 AM

Seminar 28 (Basic)

Update ASHRAE 15 and UL 60335-2-40 and UL 60335-2-89

Track: HVAC&R Systems and Equipment

Room: Orange C

Sponsor: MTG.LowGWP Lower Global Warming Potential Alternative Refrigerants

Chair: Danny M Halel, Mr, Life Member, NTHALP Engineering, O'Fallon, IL

As a designer, technician, installer or codes professional in the HVAC&R industry, one must keep up to date with all of the changes. Over the last eighteen months, ASHRAE 15 has approved and released over 25 addenda. This seminar covers these

addenda and their impact on the industry especially in the area of using slightly flammable and flammable refrigerants. The two UL 60335 standards have also released significant changes related A2L and A3 refrigerants in residential and commercial applications.

1. UL 60335-2-40 Recent Changes and Alterations
***Brian J. Rodgers**, UL LLC, Washington, DC*

2. ASHRAE 15 - 2024 Amendments and Modifications
***Stephen V Spletzer, Full Member**, The Chemours Company, Lincoln University, PA*

Monday, February 10, 10:00 AM - 11:30 AM
Virtual Paper Session (Intermediate)

Virtual Paper Session

Room:
Chair:
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1. Enhancing Building Performance through the Synergistic Incorporation of Roof-Mounted Solar Chimneys and PCM-Integrated Trombe Walls (OR-25-C147)
***Nima Ghorbani, University of Windsor**[1], Amir Fartaj, Professor, Member[1] and Mahdiyar Khalilzade Shabestari, LEED Green Associate, Student[2], (1)University of Windsor, Windsor, ON, Canada, (2)Smith and Andersen, Windsor, ON, Canada*

2. Exergy Analysis of PCM-Integrated Trombe Walls for Energy-Efficient Buildings (OR-25-C003)
***Mahdiyar Khalilzade Shabestari, LEED Green Associate, Student**, Amirhossein Khayyaminejad, Student, Amir Fartaj, Professor, Member and Nima Ghorbani, University of Windsor, University of Windsor, Windsor, ON, Canada*

3. Performance Analysis of a Radiative Cooling Panel Superimposed to an Impinging Jet Ventilation System (OR-25-C095)
***Sorour Alotaibi, Ph. D**[1] and Walid Chakroun, PhD, Fellow Member[2], (1)Abdullah Al Salem University, Kuwait, (2)Kuwait University, Kuwait*

4. Decarbonisation of a Mango Packhouse through Transcritical CO_2 Heat Pump (OR-25-C044)
*Anil Kumar, Researcher[1], **Shubhanshu Rai, PhD Student, Student**[2], Anish Modi, Associate Professor[2], Anant Shukla, Lead Expert[1] and Brian Holuj, Programme Management Officer[1], (1)United for Efficiency, Global Climate Action Unit, United Nations Environment Programme (UNEP), Paris, France, (2)Department of Energy Science and Engineering, Indian Institute of Technology Bombay (IITB), Mumbai, India*

5. Numerical and Experimental Analysis of Additively Manufactured Heat Recovery Ventilator (HRV) Systems, and a Case Study Cost Saving Estimation for a Commercial Building (OR-25-001)
***Modess Seyednezhad Sr., PhD (Sr. Thermal Engineer), Student**, Blueshift Materials, Melbourne, FL*

10:00 AM - 11:30 AM
Forum 2 (Basic)

Networking Forum for Researchers in the Built Environment

Track: Fundamentals and Applications
Room: Florida 5-6
Chair:
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Monday, February 10, 11:00 AM - 12:00 PM
Panel 3 (Basic)

MEP2040: Embodying Whole-Life Carbon

Track: Pathways to Building Decarbonization
Room: Orlando VI
Chair: Josh Jacobs, LEED AP+ BD&C, WAP Sustainability, Seattle, WA
Energy use and upfront carbon emissions of installed components cause buildings to generate significant global carbon emissions annually. The impact of mechanical, electrical, and plumbing equipment, refrigerants, and refrigerant leaks are commonly excluded from life-cycle analysis studies. The presenters provide a clear status of the building industry's progress on EPDs for MEP equipment, shed light on the complexity of the "whole carbon balance", and begin to identify a roadmap toward solutions.

This session focuses on practical strategies for engineers, architects, and building owners, including freely available tools that support embodied carbon reduction in MEP design.

Panelist 1
***Kristy Walson**, BranchPattern, Orlando, FL*
Panelist 2
***Kayleigh Houde, Associate**, BuroHappold, New York, NY*
Panelist 3
***Josh Jacobs, LEED AP+ BD&C**, WAP Sustainability, Seattle, WA*

11:00 AM - 12:00 PM

Paper Session 18

Hydrogen and Cogeneration (Poster Session)

Track: Fundamentals and Applications

Room: Orange G
Chair: Ahmed Elatar, Oak Ridge National laboratory, Associate, Oak Ridge National Laboratory, OAK RIDGE, TN
This session introduces groundbreaking innovations aimed at enhancing energy efficiency and sustainability, particularly through heat and mass transfer in hydrogen storage, the effects of hydrogen blending, leakage risks, demand response strategies, solar cogeneration, and thermal management systems.

1. Performance Evaluation and Integration Strategies for Solar Cogeneration (OR-25-C078)
***Jason J LaFleur, Full Member**, Paul D Armatis, Student, Alejandro Baez Guada, Associate Member and Ari Katz, GTI Energy, Des Plaines, IL*

2. Applicability Analysis of Thermoelectric Module-Based Active Anti-Condensation System in a Building (OR-25-C076)
***Minseong Kim, Student** and Jae-Weon Jeong, Member, Hanyang University, Seoul, Korea, Republic of (South)*

3. Evaluation of Building Demand Response Strategies in a Validated CHP and District Energy Model (OR-25-C079)
***Michael Huylo, PE, Full Member**[1] and Atila Novoselac, PhD, S-B-a Associate[2], (1)University Of Texas, Austin, TX, (2)University of Texas at Austin, AUSTIN, TX*

4. Impact of Hydrogen Blending on the Performance of a Fireplace (OR-25-C080)
***William Asher, Ph.D., Associate**, Aleksandr Fridlyand, Ph.D., Member, Mason Bushell and Brian Sutherland, Principal Engineer, GTI Energy, Des Plaines, IL*

5. Hydrogen Integration in Buildings: Investigating Leakage from Common Gas Connections (OR-25-C081)
***Aleksandr Fridlyand, Ph.D., Member**[1], Mason Bushell[1], Yan Zhao, Full Member[2] and Jessica Komar[1], (1)GTI Energy, Des Plaines, IL, (2)Gas Technology Institute, DAVIS, CA, United States*

11:00 AM - 12:00 PM

Paper Session 19

Application of Waste Heat Recovery and Other Means to Reduce Data Center Energy Use

Track: Fundamentals and Applications

Room: Orange F
Chair: Ratnesh Tiwari, Full Member, University of Maryland, COLLEGE PARK, MD
The rapid expansion of data centers has resulted in significant energy consumption and waste heat generation. Papers in this session explore the application of adsorption heat pump systems for recovering waste heat to enhance energy efficiency and explain the design strategies for optimizing airflow paths in container-type data centers to minimize static pressure difference distribution and reduce power consumption. In addition, the session explains the machine learning-based power consumption models for servers and air conditioning systems in data centers and describe the impact of sequential optimal operation using Bayesian optimization on energy savings in data center air conditioning systems.

1. Optimal Design and Application of Waste Heat Recovery for Cooling in Data Centers (OR-25-C082)
***Joo Hyun Moon, Associate** and Jinkyun Cho, Full Member, Hanbat National University, Seoul, South Korea*

2. Design Guidelines for Reducing Static Pressure Difference Distribution in Container-Type Data Center (OR-25-C083)
***YingFeng Hsu, Associate professor**[1], Chizuko Mizumoto[1], Kazuhiro Matsuda[1], Morito Matsuoka, Professor, Member[1] and Shinichi Saikawa[2], (1)Osaka University, Osaka, Japan, (2)Shinohara Electric Co., Ltd, Osaka, Japan*

3. Generic Power-Consumption-Model Building of Air Conditioning and Server for Data Center Energy Saving Operation (OR-25-C084)
YingFeng Hsu, Associate professor[1], *Yuki Sogawa*[1], *Chizuko Mizumoto*[1], *Kazuhiro Matsuda*[1], *Morito Matsuoka, Professor, Member*[1], *Yuri Mukai*[2] *and Kazuhiro Furusho*[2], *(1)Osaka University, Osaka, Japan, (2)Daikin Industries, Ltd., Osaka, Japan*

11:00 AM - 12:00 PM

Seminar 29 (Intermediate)

LIVESTREAM: Advancing Building Sustainability: ASHRAE Standard 160 and Freeze-Thaw Assessment Integration

Track: Fundamentals and Applications

NY PDH G

Room: Orlando V

Sponsor: 4.4 Building Materials and Building Envelope Performance

Chair: Neil Alexander Freidberg, Full Member, Lousiana Pacific , Mount Juliet, TN

A comprehensive overview of ASHRAE Standard 160, focusing on its application in preventing moisture damage and evaluating hygrothermal performance in buildings. It discusses input parameters, analytical tools, and performance evaluation criteria, emphasizing changes since 2016. Demonstrating the application of the FinMould model, including residential and commercial structures, it showcases the decision-making process for successful performance assessment. Moreover, it highlights the imperative of integrating freeze-thaw assessment into Standard 160, crucial for preserving heritage buildings while reducing carbon footprint. The proposed assessment procedure encompasses building review, material testing, computer simulation and engineering evaluation, ensuring robust durability in retrofit and adaptive reuse projects.

1. Introduction to ASHRAE Standard 160
Neil Alexander Freidberg, Full Member*, Lousiana Pacific , Mount Juliet, TN*

2. The Practical Application of the FinMould Model Using ASHRAE Standard 160
Manfred Kehrer*, WJE, Chicago, IL*

3. Protecting the Past and Future: Integrating Masonry Freeze-Thaw Assessment into ASHRAE Standard 160
Christopher Schumacher*, RDH Building Science, Waterloo, ON, Canada*

11:00 AM - 12:00 PM

Seminar 30 (Intermediate)

Cutting-Edge Japanese Technologies on Advanced Artificial Intelligence

Track: Artificial Intelligence, Building Automation and Controls

NY PDH G

Room: Orange A

Chair: Ryozo Ooka, PhD, Fellow Member, IIS University of Tokyo, Tokyo, Japan

The SHASE Technology Award-winning AI-based initiative to reduce energy consumption for air conditioning and facility power consumption is presented at this seminar. The first is an energy management system that supplies electricity, cooling and heating to large-scale buildings using AI to predict loads and create operation plans for each heat source system based on weather data and operation records. Second, the data center combines AI control, a high-efficiency air conditioning system, and direct outside air cooling to minimize the power consumption of the entire data center, including that servers, achieving one of the highest levels of energy efficiency in Japan.

1. Energy Management Using AI at an Energy Center That Provides Heat and Electricity in Tokyo
Shion Okamoto*, MORI BUILDING CO.LTD., Tokyo, Japan*

2. Japan's Highest Level of Energy-Saving Data Center Using AI Control
Naoki Onishi[1] *and Masahiko Fujisaki, Full Member*[2]*, (1)KAJIMA CORPORATION, Tokyo, Japan, (2)Takasago Thermal Engineering Co., Ltd., Tokyo, Japan*

11:00 AM - 12:00 PM

Seminar 31 (Intermediate)

Powering a Resilient Future with Microgrids

Track: Energy Storage and Grid Resiliency

Room: Orange B
Sponsor: 6.7 Solar and Other Renewable Energies, 7.5
Chair: Konstantinos Kapsis, The University of Waterloo, Waterloo, ON, Canada
As buildings and transportation move toward electrification and decarbonization, microgrids will be pivotal. This seminar aims to present the latest advancements in microgrid technology and electric storage solutions. Industry professionals will gain insights into the challenges, design, implementation, and benefits of microgrids through real-world case studies. Attendees will explore how microgrids enhance energy resilience and sustainability, focusing on renewable generation, energy storage, grid stability, and building-grid interactions. The scope includes practical applications and lessons learned from diverse implementations, empowering participants to leverage microgrid technology for a resilient and sustainable built environment.

1. Challenges and Operation of Remote Grids and Microgrids
***Veronique Delisle, Ing., Ph.D., Member**, Natural Resources Canada, Varennes, QC, Canada*
2. A Large Microgrid Community with Building-Integrated Solar Panels, Heat Pumps, Battery Storage and Electric Vehicles
***Andreas K Athienitis, Ph.D., P.E., Fellow Life Member**, Concordia University Dept Of Bldg Civil, Montreal, QC, Canada*
3. Microgrids in the Midwest
***Svein O Morner, Full Member**, HGA, Inc, Middleton, WI*

11:00 AM - 12:00 PM
Seminar 32 (Intermediate)

What Are the Changes Required for Climate Change-Resistant Infrastructure for Industrialized Construction?

Track: Industrialized Construction: Opportunities and Challenges
Room: Orange C
Sponsor: 1.4 Control Theory and Application, 7.5 Smart Building Systems , College of Fellows
Chair: Carol Lomonaco, Full Member, Carol Lomonaco - retired, Wauwatosa, WI
How will the mandate for climate-resistant infrastructure change the building materials and the necessary changes to the operations side of the business in order to meet the new government regulations that will be required in 2025? This seminar shares the types of new approaches, new materials and the new challenges that the construction companies are now challenged with.

1. Advancing Sustainable Building Materials: Balancing Demand and Supply in India Construction Industry
***Satish Kumar, President & Executive Director, Fellow ASHRAE**, Alliance for an Energy Efficient Economy, New Delhi, India*
2. Efficient, Resilient and Sustainable Design Considerations for Industrial Construction or Renovation in the Face of Climate Change
***Craig Mays, PE, CEM, LEED AP**, Johnson Controls*

11:00 AM - 12:00 PM
Seminar 33 (Intermediate)

What Future Weather Data Do You Need for Future-Proofing?

Track: Future-Proofing the Built Environment
Room: Orange E
Sponsor: 4.2 Climatic Information, 2.5 Global Climate Change
Chair: Eric L Peterson, PhD, PE, CEng, Full Member, Visiting Research Fellow-Univ. of LEEDS, Leeds, West Yorkshire, United Kingdom
Accurate future weather information is needed to avoid underreaction or overreaction to climate change. Using future weather adds complexity to performing energy, resilience, and sustainability assessments. The United States Department of Energy has invested in creating a range of future weather products including typical, actual, and extreme temperature conditions. A survey has also been released that enables analysts for the built environment to share what they are using and what they need. Prepare for a highly interactive discussion where the presenters give short introductory talks followed by discussion with the audience.

1. Types and Issues Surrounding Using Future Weather
***Daniel L. Villa, PE, Full Member**, Sandia National Laboratories, Alamo (virtual employee), TX*
2. The Uncertainty Never Goes Away (So Stop Wishing for It to Go Away)
***Parag Cameron-Rastogi, PhD, CEng, MCIBSE, MASHRAE, Full Member**, GRESB, Glasgow, United Kingdom*

2:15 PM - 3:45 PM
Debate 1 (Intermediate)

LIVESTREAM: Is ASHRAE on the Right Path? A College of the Fellows Debate on Decarbonization

Track: Pathways to Building Decarbonization
Room: Orlando V
Sponsor: 1.4 Control Theory and Application, College of the Fellows
Chair: Michelle Kiana Shadpour, PE, Full Member[1], Ginger Scoggins, PE, CEM, CxA, FASHRAE, Presidential Fellow Member[2], Marwa Zaatari, PhD, Full Member[3] and Michelle Kiana Shadpour, PE, Full Member[1], (1)SC Engineers, Inc, San Diego, CA(2)Engineered Designs Inc, CARY, NC(3)D Zine Partners, Austin, TX
Many ASHRAE members acknowledge that reducing fossil fuel consumption is imperative for addressing today's environmental challenges. However, the best approach remains a contentious issue. This dynamic debate examines current approaches to decarbonization, and poses the question, “are we on the right path?” Some entities have adopted drastic measures to reduce their carbon footprint while others are taking a more gradual, 'soft landing' approach. In this debate, we bring together an all-women panel of engineers who aim to address these pressing questions, offering diverse perspectives on the effectiveness and consequences of various decarbonization strategies.

Tuesday, February 11

Tuesday, February 11, 8:00 AM - 9:30 AM
Debate 2 (Intermediate)

Artificial Intelligence is a Hoax! A College of Fellows Debate

Track: Artificial Intelligence, Building Automation and Controls
Room: Orlando VI
Sponsor: 1.4 Control Theory and Application, 1.7 Business, Management & General Legal Education , College of the Fellows
Chair: Michelle Kiana Shadpour, PE, Full Member, SC Engineers, Inc, San Diego, CA, Krishnan Gowri, PhD, Life Member, Energy Solutions, CHICAGO, IL, Charles H Culp III, Dr, Fellow Life S-B-a Member, Texas A&M University, COLLEGE STATION, TX, Jayson F Bursill, Ph.D, P.Eng., S-B-a Member, Delta Controls Inc., Gloucester, ON, Canada, Mitchell Swann, P.E., Life Member, Resolution Management Consultants, Philadelphia, PA, Aaron Sorrell, Full Member, Federal Reserve Bank of Boston , BOSTON, MA and Stephen B Roth, PE, Full Member, Carmel Software Corp, SAN RAFAEL, CA
Following the 2024 Winter Conference's discussion on whether AI constitutes cheating, this debate revisits the transformative potential of AI in the HVAC industry. A year has passed, and we now question whether AI has lived up to its promises. Theoretically, AI offers significant benefits: enhancing energy efficiency, reducing operating costs, and improving occupant comfort. Predictive analytics can optimize system performance, diagnose issues, and provide real-time support to technicians. However, critics argue that AI incurs prohibitive costs and lacks the sophistication for reliable results that could lead to serious problems. Is AI a Hoax? Join us and decide for yourself!

Michelle Shadpour 1

8:00 AM - 9:30 AM
Paper Session 20

A Little Bit of Everything 2 (Poster Session)

Track: Fundamentals and Applications
NY PDH
Room: Orange G
Chair: Songhao Wu, Associate, CMTA, Inc, W LAFAYETTE, IN

Discover more breakthroughs in building performance and energy systems. Studies include residential and commercial applications, calculation optimization, data collection methods, to building management practices. These insights propel sustainable building practices and enhance energy efficiency.

1. Wind Power Forecasting through Data-Driven Approach Using Transformer Architecture (OR-25-C123)
Maryam Soleymani[1], *Mahdi Bonyani*[2] *and Chao Wang, Associate Professor*[2], *(1)Louisiana State University, Baton Rouge, LA, (2)Louisiana State University, BATON ROUGE, LA*

2. Occupancy-Based HVAC Control through Process-Driven Models with Data-Driven Approach Using Deep Reinforcement Learning (OR-25-C122)
Mahdi Bonyani*, Maryam Soleymani and Chao Wang, Associate Professor, Louisiana State University, BATON ROUGE, LA*

3. Life Cycle Carbon and Cost Analysis of Exterior Solar Shading Systems Used in Residential Buildings Located in Cold Climate Zones (OR-25-C085)
Lin Wang, Full Member*, Zhe Xiao, Abdelaziz Laouadi and Michael Lacasse, National Research Council Canada, Ottawa, ON, Canada*

4. Evaluating Methodologies to Account for Baseload and Non-Baseload Emission Factors Using Energyplus Simulations of Net Zero Energy Home Models (OR-25-C086)
Rohit Jogineedi, PhD, Associate[1], *Alex Fridyland, Ph.D., Associate Member*[2] *and Kaushik Biswas, Ph.D.*[1], *(1)Gas Technology Institute, DAVIS, CA, United States, (2)Gas Technology Institute, Chicago, IL*

5. When Variability on Climate and Occupants Meet – How Climate Change Can Affect Different Occupants in Their House? (OR-25-C088)
Marie-Pier Trepanier, Student *and Louis Gosselin, P.Eng., Ph.D., S-B-a Member, Universite Laval, Quebec City, QC, Canada*

6. Innovative ADR Solution Enhances Energy Optimization and Expands Economic Value (OR-25-C089)
Gary Morsches, Full Member*, DemandQ, Waltham, TN*

7. Optimal Control of Personalized Conditioning Systems in an Office Building through Reinforcement Learning: A Case Study (OR-25-C090)
Yiting Yang, Student[1] *and Bing Dong, Ph.D., S-B-a Member*[2], *(1)Syracuse University, Syracuse, NY, (2)Syracuse University, SYRACUSE, NY*

8. Investigation of the Impact of Thermostat Noise on the Effectiveness of Smart Thermostat Based FDD Techniques (OR-25-C092)
Kevwe Andrew Ejenakevwe, Student[1] *and Li Song, PhD, S-B-a Member*[2], *(1)university of oklahoma, NORMAN, OK, (2)University of Oklahoma, NORMAN, OK*

9. Development of the AI-Tech Assistant to Transfer Research Outcome Knowledge for Accelerating Low-Cost MPC Technology Deployment (OR-25-C093)
Sang woo Ham, Associate[1], *Juwan Ha, Student*[2], *Donghun Kim, Full Member*[1] *and Seungjae Lee, Ph.D., Associate*[3], *(1)Lawrence Berkeley National Laboratory, Berkeley, CA, (2)NC STATE University, RALEIGH, NC, (3)University of Toronto, Toronto, ON, Canada*

8:00 AM - 9:30 AM

Paper Session 21

Ways to use Radiant Systems and Heat Pumps with Auxiliary Heat

Track: Fundamentals and Applications

NY PDH

Room: Orange E
Chair: Sonya M Pouncy, CEM, LEED AP, Full Member, Building Vitals, Detroit, MI

This session presents two technologies: radiant systems and heat pumps with auxiliary heat. This includes using a generative workflow for designing radiant cooling panels, novel radiative cooling panels combined with an impinging jet ventilation system, high thermal mass radiant systems, and energy flexibility potential in such systems. The session also explains the limitations of air-source heat pumps in cold weather and the integration of modulating auxiliary backup heat and dynamic temperature monitoring to minimize the 'cold blow' effect and enhance thermal comfort.

1. Performance-Based Generative Workflow for Designing Radiant Panels (OR-25-C094)
Kian Wee Chen, Associate[1], *Ippei Izuhara, Full Member*[2] *and Forrest Meggers, Ph.D., Associate*[3], *(1)Global Environmental Technologies Inc., (2)Global Environmental Technologies Inc, Princeton, NJ, (3)Princeton University School of Architecture, Princeton, NJ*

2. Using Small Amounts of Resistance Heat to Improve Thermal Comfort in Residential Air-Source Heat Pumps (OR-25-C096)

Nadah Faris Al Theeb, Ph.D student, Student[1], *Abd Alrhman Bani Issa*[2] *and Kevin J. Kircher*[2], *(1)Purdue University, W LAFAYETTE, IN, (2)Purdue University, West Lafayette, IN*

3. Minimizing Auxiliary Heat Use for Cold Climate Operation of Air Source Heat Pumps (OR-25-C097)
Sugirdhalakshmi (Sugi) Ramaraj, Researcher, Associate[1] *and Jon Winkler*[2], *(1)National Renewable Energy Laboratory (NREL), (2)National Renewable Energy Laboratory, Golden, CO*

4. Energy Flexibility and Sensitivity Analysis of High Thermal Mass Radiant Terminals (OR-25-C098)
Guoquan Lyu, Student[1] *and* ***Carlos Duarte, Ph.D., Associate***[2], *(1)Zhejiang University, Hangzhou, Zhejiang, China, (2)UC Berkeley, Center for the Built Environment, Berkeley, CA*

8:00 AM - 9:30 AM

Paper Session 22

All About Water Heaters

Track: Fundamentals and Applications

NY PDH

Room: Orange F
Chair: Edward A Vineyard, Fellow Member, Vineyard Associates, KNOXVILLE, TN
Energy use by water heating in residential and commercial buildings plays a significant role in energy cost, peak demand, and carbon emissions. Papers in this session explore various options to minimize energy use, carbon emissions, and peak load associated with water heaters. This includes effective integration between the ejector and heat pump, thermal storage, the use of surplus energy generated during off-peak periods, mixing between hot and cold water in water heaters, and load management strategies.

1. Vapor Compression-Ejector Heat Pump for Domestic Water Heater (OR-25-C099)
Ramy H Mohammed, Full Member[1], *Aleksandr Fridlyand, Ph.D., Member*[2], *Kashif Nawaz, PhD, Associate*[3] *and Hongbin Ma, Associate*[4], *(1)GTI Energy, (2)GTI Energy, Des Plaines, IL, (3)Oak Ridge National Lab, Oak Ridge, TN, (4)University of Missouri*

2. Numerical Studies of Heat Pump Water Heater Tanks Using 3D Unsteady Reynolds-Averaged Navier-Stokes and Large-Eddy Simulation Approaches (OR-25-C101)
Thien Nguyen, Senior R&D Staff, ***Joseph D Rendall, Associate R&D Staff, Associate*** *and Kashif Nawaz, PhD, Associate, Oak Ridge National Lab, Oak Ridge, TN*

3. Measuring Methane Emissions from Residential Storage Tank Water Heaters (OR-25-C102)
Ramy H Mohammed, Full Member[1], *Abbas Ahsan, Associate*[2] *and Alex Fridlyand, Ph.D., Associate*[3], *(1)GTI Energy, (2)GTI Energy, Des Plaines, IL, (3)Gas Technology Institute, DAVIS, CA, United States*

4. Comparing Current Dhw Sizing Methods with Reality (OR-25-C103)
Cristalle Mauleon, Engineering Manager[1], *Gary A Klein, Owner, Life Member*[2], *Alyza Khan, Engineer II*[1] *and Ramanujan Vetrivel, Project Manager I*[1], *(1)Lincus Inc., Monrovia, CA, (2)Gary Klein and Associates, Rancho Cordova, CA*

8:00 AM - 9:30 AM

Seminar 34 (Intermediate)

Cutting-Edge Japanese Technologies on Decarbonization

Track: Pathways to Building Decarbonization

NY PDH G

Room: Orange A
Chair: Akio Miyara, PhD, Full Member, Saga University, Saga Shi, Japan
Decarbonization strategies introduced into three buildings that have won the SHASE Annual Award are presented. The first is a Thermo Active Building System (TABS) in a steel-frame building, which reduced operational carbon by 50% and whole life carbon by 35%. The second is decarbonization methodologies for a multi-story office building using conventional equipment. The third is a university campus, which achieved a reduction of 25% in operational CO2 emissions compared to the initial completion phase through a decade-long commissioning, making full use of BEMS.

1. Whole Life Carbon Reduction through the Implementation of TABS in Japan
Masatoshi Kuboki, Full Member, *NIKKEN SEKKEI LTD., Tokyo, Japan*

2. Decarbonization Methodologies for Multi-Story Buildings Using Conventional Equipment
Taiki Kobayashi, Associate, *Mitsubishi Electric Corporation, Tokyo, Namibia*

3. Energy Savings and CO2 Reduction on the University Campus through Decade-Long Commissioning Activities

***Masaya Nishikwa, PhD, Associate**, TOKYO DENKI UNIVERSITY, Tokyo, Japan*

8:00 AM - 9:30 AM

Seminar 35 (Advanced)

Energy Rationality with Waste Heat for District Heating and Cooling

Track: Pathways to Building Decarbonization

Room: Orange B

Sponsor: 7.4 Exergy Analysis for Sustainable Buildings (EXER), 6.9 Thermal Storage , 6.2 District Energy, HCDG MTG

Chair: Yunyang Ye, Ph.D., Associate, The University of Alabama, TUSCALOOSA, AL

Escalating energy consumption and pollution worsens the weather conditions, profoundly influencing people's lives. About 72% of global primary energy consumption is dissipated through transmission and conversion. A significant portion is waste heat, making it a major contributor to energy loss. Depending on the temperatures, the quality of waste heat ranges from approximately 13% to over 30%, making it suitable for applications like space preheating/heating and domestic hot water. To support building decarbonization and enhance energy use efficiency, this seminar discusses energy rationality with waste heat for district heating and cooling, aiming to reduce energy waste and improve energy efficiency.

1. Exergy Rationality for Decarbonization in Low-Temperature District Heating
***Atilla Biyikoglu, Ph.D., S-B-a Member**[1] and Birol I Kilkis, Ph.D., Fellow Life Member[2], (1)Gazi University, Ankara, Turkey, (2)OSTIM Technical University, Ankara, Turkey*

2. Drain-Source Heat Pump Water Heaters for Multifamily Housing Waste Heat Capture and Peak Load Shifting
***Joseph D Rendall, Associate R&D Staff, Associate**, Oak Ridge National Laboratory*

3. Evaluating Energy Performance and Emission Levels of Different Heating System Upgrades for a Historic Building Portfolio with District Heating and Cooling System
***Madhu Jan**, Pacific Northwest National Laboratory*

4. New ASHRAE Hot Climate Design Guide Includes Low Carbon District Cooling
***Francis A Mills, Chartered Engineer, Fellow Life Member**, Frank Mills Consulting, Leyland, United Kingdom*

8:00 AM - 9:30 AM

Seminar 36 (Basic)

LIVESTREAM: Interdisciplinary Dimensions of Occupant Behavior, Indoor Environmental Quality for Building Health

Track: Ventilation and Indoor Environmental Quality

Room: Orlando V

Sponsor: 7.3 Operation, Maintenance and Cost Management , TC7.10

Chair: Chien-fei Chen, PhD, University of Tennessee, KNOXVILLE, TN

Building energy consumption and the built environment significantly influence various aspects of our lives, including climate change, indoor environmental quality (IEQ), and physical and mental health.
Notably, the integration of sustainable building technology with behavioral and socio-demographic dimensions in building research is lacking. This seminar proposal emphasizes human-centric research as the crucial link between the built environment, occupant behavior, social factors and the creation of healthy and sustainable communities. Our aim is to promote interdisciplinary research that contributes to developing human-centric building topics in decarbonization, sustainability, health, and occupant behaviors.

1. Investigations of Indoor Environment Quality for HVAC Occupancy-Centric Control in Commercial Buildings
***Zheng O'Neill, Ph.D., P.E., Fellow Member**, Texas A&M University , College Station, TX*

2. The Multi-Dimensionality of Energy Burden, Climate Change Perception and Built Environment on Mental Health
***Wei-An Chen, Ph.D., Student**, Texas A&M University, COLLEGE STATION, TX*

3. Housing Energy, Indoor Air Quality and Health Challenges in Native Alaskan Communities
***Kristen Sara Cetin, PE, Full Member**, Michigan State University, EAST LANSING, MI*

4. Harnessing Energy-Efficient Ventilation for Pandemic Response and Enhanced Occupant Well-being: Opportunities and Challenges
***Zhihong Pang, Assistant Professor, Associate**, Louisiana State University , BATON ROUGE, LA*

8:00 AM - 9:30 AM

Seminar 37 (Basic)

Myth Buster: The Ground Heat Exchanger Needs to be Balanced?

Track: HVAC&R Systems and Equipment

Room: Orange C

Sponsor: 6.8 Geothermal Heat Pump and Energy Recovery Applications, 9.7 Educational Facilities

Chair: Catherine A Tinkler, EBCP, PMP, LEED AP O+M, Associate, Page Southerland Page, Inc., Weston Lakes, TX

Busting the myth about ground heat exchange imbalance, starts with a grounded understanding of GHEX design fundamentals. Applying proven design methods to calculations and exploring risks that may arise in the future are key to designing a system intended to provide efficient operations over the full life of the building. This session starts with a review of proven design methods, identifies tradeoffs to be considered during design, and presents solutions applicable to hot or cold climates. Reviewing case studies and lessons learned based upon long-term operations confirms that with the right design these systems are an effective long-term strategy.

1. Getting Grounded
***Lisa M. Meline, P. E., Full Member**, Meline Engineering Corporation, Sacramento, CA*

2. Strategies for Imbalanced Ground Heat Exchangers in Cold Climates
***Andrew A DeRocher, Full Member**, HGA, MINNEAPOLIS, MN, United States*

3. Forty Year Evolution of Simple, Elegant, Efficient GSHPs for Texas Schools
***Steve Kavanaugh, PhD, Fellow ASHRAE**, University of Alabama - Tuscaloosa, Tuscaloosa, AL*

Tuesday, February 11, 9:45 AM - 10:45 AM

Paper Session 23

Impact on Indoor Air Quality from Cooking Emissions and Outdoor Sandstorms

Track: Fundamentals and Applications

Room: Orange F

Chair: Sonya M Pouncy, CEM, LEED AP, Full Member, Building Vitals, Detroit, MI

Emissions from indoor pollutants, such as cooking emissions, and outdoor sources, such as dust particles from sandstorms, can negatively affect indoor air quality (IAQ). These papers present common burner technologies used in restaurants and their performance on emissions and efficiency, the effect of cooking emissions on residential IAQ, and the impact of various hood designs. The session also delves into the effects of dust intrusion on indoor particulate matter (PM) levels in educational settings, the application of machine learning models to forecast indoor PM concentrations during extreme pollution events, and ways in which simplified input configurations can improve model efficiency.

1. Non-Powered Commercial Cooktop Burners Optimization for Efficiency Improvement and NOx Reduction (OR-25-C104)
***Yan Zhao, Full Member**, Jacob Pixler, Brian Sutherland, Principal Engineer, Nickolas Daniels and Frank Johnson, GTI Energy, Des Plaines, IL*

2. Field Evaluation of Indoor Air Quality in Residential Kitchens (OR-25-C105)
***Richard T Swierczyna, Full Member**[1], Michael Frank Johnson, Ph.D., Associate[1], Jason Stein, Engineer, Associate[1], Jacob Pixler[2] and Jason J LaFleur, Full Member[2], (1)Gas Technology Institute, DAVIS, CA, United States, (2)GTI Energy, Des Plaines, IL*

9:45 AM - 10:45 AM

Paper Session 24

Desiccant and Sorption

Track: Fundamentals and Applications

Room: Orange G
Chair: Zhenglai Shen, R&D Associate Staff, Associate, Oak Ridge National Laboratory, OAK RIDGE, TN
This study will look at liquid dessicant in a DOAS and counterflow system. Liquid desiccant materials have different characteristics as compared to solid desiccants. In addition, liquid desiccants have lower values for viscosity, vapor pressure, and crystalline point than a solid desiccant system. Liquid desiccants are the liquid compounds that have a high affinity for water vapor and can dehumidify air by absorbing water vapor from it. The parameters such as energy storage density, availability and cost should be considered while choosing a liquid desiccant.

1. Achieving 50% Energy Reduction with Liquid Desiccant DOAS (OR-25-C107)
Philip Farese, PhD, Associate*, Aaron Meles, Associate, Rachel Ellman and Kyle Troskot, Associate Member, Mojave Energy Systems, Sunnyvale, CA*
2. Experimental Analysis of a Counter-Flow Liquid Desiccant System Based on a Solution Atomization with Fine Droplets (OR-25-C109)
Soo-Jin Lee, Student *and Jae-Weon Jeong, Member, Hanyang University, Seoul, Korea, Republic of (South)*

9:45 AM - 10:45 AM
Seminar 38 (Basic)

Challenges and Opportunities with Low-GWP Refrigerants in Transportation Applications

Track: Refrigeration and Refrigerants
G
Room: Orlando VI
Sponsor: 10.6 Transport Refrigeration, 9.3 Transportation Air Conditioning
Chair: Riley B Barta, PhD, Associate, Purdue University, W LAFAYETTE, IN
This seminar focuses on the unique challenges faced by the transportation sector due to the transition to lower-GWP refrigerants. Both air conditioning and refrigeration will be considered, and automotive, refrigerated trailers, mass transit and passenger rail applications will be presented. Motivated by the continued GWP phase down, the advancements with flammable, high pressure and mixture refrigerants in the context of transportation will be highlighted and discussed from industry and academic perspectives.

1. Lower GWP Refrigerant Alternatives for Transport Refrigeration
Alexander Schmig, Full Member*, Trane Technologies, La Crosse, WI*
2. Sustainable Air Conditioning System Using Transcritical CO2 for High-Speed Rail Applications
Stefan Elbel, Full Member*, TU Berlin, Urbana, IL*
3. Low GWP Alternatives for R410A, R407C and R134a in Air Conditioning System for Mass Transit Applications
Nilesh Purohit, PhD, Associate*, Honeywell, MINNEAPOLIS, MN*

9:45 AM - 10:45 AM
Seminar 39 (Intermediate)

LIVESTREAM: International Energy Agency Energy in Buildings and Communities Programme (IEA EBC) ANNEX 81: Data-Driven Smart Buildings

Track: Artificial Intelligence, Building Automation and Controls
G
Room: Orlando V
Sponsor: 7.5 Smart Building Systems
Chair: Zheng O'Neill, Ph.D., P.E., Fellow Member, Texas A&M University , College Station, TX
This seminar introduces the nearly-completed International Energy Agency's ANNEX 81 project – Data-Driven Smart Buildings. This project imagines a future world empowered by access to discoverable, reliable, ubiquitous real-time data from buildings, such that digital solutions can rapidly scale and where energy efficiency knowledge can be widely encapsulated and disseminated within highly accessible software 'applications' such as model predictive control (MPC) and fault detection and diagnosis (FDD) applications. This seminar introduces activities of this Annex with emphases on Open Data and Data Platforms, MPC, Application and Services (e.g., FDD), Case Studies and Results Dissemination.

1. Subtask A: Open Data and Data Platforms

***Stephen D. White, Dr., Associate**, Commonwealth Scientific and Industrial Research Organisation, Australia*

2. Subtask B: Leveraging Data to Enable Model Predictive Control in Buildings
***Jose A. Candanedo, Dr., Full Member**, Université de Sherbrooke, Canada*

3. Subtask C: Applications and Services
***Jin Wen, Ph.D., Fellow S-B-a Member**, Drexel University, PHILADELPHIA, PA*

9:45 AM - 10:45 AM

Seminar 40 (Basic)

Lunar Renewable Energy Technologies

Track: Fundamentals and Applications

Room: Orange A

Sponsor: 9.13 Extraterrestrial and Deep Space Environmental Control Systems, TC 9.13

Chair: Michael B Pate, Professor, Life Member, Texas A&M University, College Station, TX

A functioning lunar habitat needs continuous sources of power to operate HVAC equipment and systems for human comfort and IAQ. Renewable Energy Technologies developed for earth may in some cases be used in lunar applications; however, significant modifications must be made to accommodate the lack of an atmosphere and differing solar irradiation characteristics for the lunar environment. Challenges to be encountered and overcome will be presented, along with comparisons of earth and lunar solar irradiation, temperatures plus their swings, soils, etc. Finally, renewables that show promise in the lunar environment will be presented and described.

1. Solar Energy As a Renewable Source for Lunar Habitat Applications
***Adrian Alvarez, Professional Engineer**, Jacobs*

2. Lunar Power Based on Thermal Heat Engines
***Jimmie R Smith III, Research Engineer, Student**, Texas A&M University, College Station, TX*

9:45 AM - 10:45 AM

Seminar 41 (Intermediate)

Thermal Storage and CHP Support Electric Grid Resilience

Track: Energy Storage and Grid Resiliency

Room: Orange B

Sponsor: 1.10 Combined Heat and Power Systems

Chair: Geoffrey Bares, Associate, CenTrio Energy, Chicago, IL

With decarbonization of the power grid and a growth in intermittent renewables, Combined Heat & Power (CHP) with thermal storage and heat to power generation can level out energy demand to ensure power stability at the grid edge. In an electrified world where most space heat is generated using electric heat pumps, thermal storage and CHP can play a crucial role in maintaining local grid stability. From CHP with built in thermal storage to conversion of thermal to electric energy, this seminar provides a view of the current state of the technology and links energy storage directly to grid resilience.

1. Thermal and Electric Decoupling with TES/Flex CHP
***Levi Hoiriis**[1] and Mahabir S Bhandari, BEMP, Full Member[2], (1)Sterling Energy, Dunwoody, GA, (2)Oak Ridge National Laboratory, OAK RIDGE, TN*

2. Waste Heat Recovery, TES and ORC
***Jere Kimmel, Associate**, Midwest Machinery*

3. CHP's Fit in Electrification
***Gearoid Foley, Full Member**, Integrated CHP Systems, Princeton, NJ*

9:45 AM - 10:45 AM

Seminar 42 (Intermediate)

The Wonderful World of Dedicated Outdoor Air Systems and Energy Recovery Equipment

Track: HVAC&R Systems and Equipment

NY PDH G

Room: Orange C

Sponsor: 5.5 Air-to-Air Energy Recovery, 7.4 Exergy Analysis for Sustainable Buildings (EXER)

Chair: Paul L Pieper, Eng, Full Member, The Master Group, Ottawa, ON, Canada

Industry often uses the term DOAS interchangeably to represent both a piece of equipment (DX-DOAS) and a combination of equipment or system. This seminar will dive into the nuances of each type of DOAS, both equipment and system, codes and regulations that impact DOAS and Energy Recovery Equipment, and the benefits of a DOAS system approach. Additionally, we will discuss shell improvements for RTU equipment, including DX-DOAS, and the value of metrics that represent a holistic look at equipment.

1. So You Think You Know DOAS and Exhaust Energy Recovery?
***Eric Erdman, PE, Associate**, Greenheck Fan Corporation, SCHOFIELD, WI*

2. What about RTUs?
***Chris Keith Wolgamott, CEM, CDSM, Associate**, Northwest Energy Efficiency Alliance, PORTLAND, OR*

3. DOAS: Deep Dive into the Benefits of a "System" Approach
***Jordan Pratt, PE, Full Member**, Energy350, Portland, OR*

9:45 AM - 10:45 AM

Workshop 3 (Basic)

From Culture to Connection: Engaging, Developing and Retaining your Workforce

Track: Future-Proofing the Built Environment

NY PDH G

Room: Orange E

Sponsor: ASHRAE Board of Directors DEI Advisory Subcommittee, YEA – Young Engineers in ASHRAE

Chair: Madison W Schultz, PE, Full Member, ADG|Blatt, Oklahoma City, OK

In today's competitive business landscape, a strong company culture is more than just a buzzword—it's a key driver of success. This interactive, hands-on workshop will explore elements that contribute to a positive and productive company culture, with an emphasis on creating inclusive environments. Participants will learn about cross-generational collaboration among employees, how to connect diverse perspectives and brainstorm actionable strategies to foster an environment where every employee can thrive and be motivated for years to come.

1. Recruitment, Retention and Building a Collaborative Workplace Culture
***Craig A Wanklyn, PE, Full Member**, Kansas State University, MANHATTAN, KS*

2. Actionable Strategies for Inclusivity and Connection
***Madison W Schultz, PE, Full Member**, ADG|Blatt, Oklahoma City, OK*

Tuesday, February 11, 10:00 AM - 11:30 AM

Virtual Paper Session (Basic)

Virtual Paper Session 2

Room:

Chair: Li Song, PhD, S-B-a Member, University of Oklahoma, NORMAN, OK

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1. Promote Gender Equity and Inclusion in the Building Construction Industry with Digitalization Technologies (OR-25-C075)

*Reyhaneh Moazami Goodarzi[1], **Mohammad Saleh Nikoopayan Tak, Student**[1] and Yanxiao Feng, Associate[2], (1)Hillier College of Architecture and Design, New Jersey Institute of Technology, Newark, NJ, (2)School of Applied Engineering and Technology, New Jersey Institute of Technology, Newark, NJ*

2. Assessing Climate Change Effects on Building Energy Sector in a Mixed-Humid Climate Zone Using Urban-Scale Building Energy Modeling (UBEM) (OR-25-C022)

Ramin Jalilian[1] *and Ehsan Kamel, Ph.D., CEM, S-B-a Associate*[2]*, (1)New York Institue of Technology, (2)New York Institute of Technology (NYIT), NY*

Tuesday, February 11, 10:15 AM - 11:45 AM

AHR Expo Session 1 (Intermediate)

Social, Financial and Environmental Perspectives on Building Low-Carbon Solutions

Track: Pathways to Building Decarbonization

Room: W310

Sponsor: 6.10 Fuels and Combustion

Chair: Gunther Gottfried Berthold, Full Member, Beckett Thermal Solutions, Formigine, NJ, Italy

This seminar explores the financial and environmental impacts of carbon emission reduction strategies. It will review concepts like Net Present Abatement Value (NPAV), focusing on consumer behaviors, willingness to pay, and the economic challenges such as the high Shadow Price of Carbon (ShPC) compared to the Social Cost of Carbon (SCC). It will also discuss a techno-economic analysis comparing different residential heating systems, including bioheat, natural gas, and electric heat pumps; highlighting the emissions and net present values. It will compare biofuel conversion and heat pumps for homes heated with fuel oil, considering regional factors, grid characteristics, and operating costs.

1. Challenges and Opportunities in Maximizing the Net Present Abatement Value (NPAV) for Carbon Emission Reduction

Alan Chmiel, Full Member*, R.W. Beckett, North Ridgeville, OH*

2. Exploring the Environmental and Financial Impacts of Low-Carbon Heating Solutions

Jenny Rose Frank, Assistant Professor*, State University of New York College of Environmental Science and Forestry (SUNY ESF), Syracuse, NY*

3. Decarbonizing Home Heating Currently Based on Fuel Oil

Roger D Marran, Full Member*, Energy Kinetics, Inc., Lebanon, NJ*

Tuesday, February 11, 11:00 AM - 12:30 PM

Paper Session 25

Thermal Comfort

Track: Fundamentals and Applications

NY PDH G

Room: Orange C

Chair: Edward A Vineyard, Fellow Member, Vineyard Associates, KNOXVILLE, TN

Maintaining thermal comfort is essential in building system operation while obtaining energy efficiency and providing grid service. This session covers several thermal comfort studies including comfort modeling, measurements, optimal operation and dynamic impact on thermal comfort.

1. Using Personal Exposure Measurement to Manage Environmental Stressors (OR-25-C110)

Clinton J Andrews, Full Member*, Rutgers University , PISCATAWAY, NJ*

2. The Effect of Dynamic Pricing on Residential Buildings: An Experimental Investigation to Evaluate Energy Flexibility Potential and Temperature Variation in Demand Response (OR-25-C111)

Andrea Petrucci, Ph.D. Student, Student[1]*, Benoit Delcroix, Ph.D.*[2]*, Luis Fernando Rueda Vasquez, Researcher*[2] *and Andreas K Athienitis, Ph.D., P.E., Fellow Life Member*[3]*, (1)Concordia University, Montreal, QC, Canada, (2)Hydro-Québec Research Centre, Laboratoire des Technologies de l'Energie (LTE), Shawinigan, QC, Canada, (3)Concordia University Dept Of Bldg Civil, Montreal, QC, Canada*

3. A Simplified Predictive Model for Enhancing Thermal Comfort in University Classrooms (OR-25-C112)

Roee Morag, Student Member and ***Jennifer L Mott Peuker, S-B-a Associate****, Cal Poly San Luis Obispo, Atascadero, CA*

4. Optimizing and Predicting Thermal Comfort and Energy Consumption in a Shared Office Environment (OR-25-C113)

Saeid Chahardoli, Ph.D., Student[1]*, Mina Lesan, Ph.D. student in Construction Management*[2] *and Arup Bhattacharya, Ph.D., Associate*[3]*, (1)LOUISIANA STATE UNIVERSITY, BATON ROUGE, LA, (2)Louisiana State University, Baton Rouge, LA, (3)Louisiana State University, BATON ROUGE, LA*

11:00 AM - 12:30 PM

Paper Session 26

Decarbonization in Residential Buildings

Track: Fundamentals and Applications

NY PDH G

Room: Orange E

Chair: Vrushali Mendon, Associate, Pacific Northwest National Laboratory, Richland, WA

The papers in this session explore different methods of reducing carbon emissions in residential buildings and houses of worship, from localized heating systems to combined heat and power systems.

1. Decarbonizing Historic Houses of Worship through Localized Pew Heating (OR-25-C114)

Jessica Burke, EIT, Associate[1], ***Quinn Parker Graessle, Student***[2], ***Paige Fischer, Associate***[3], ***Joseph M Tornes, EI, Associate***[4] *and* ***Amanda L. Webb, PhD, Full Member***[1], *(1)University of Cincinnati, CINCINNATI, OH, (2)UC Berkeley, CINCINNATI, OH, (3)CMTA, Cincinnati, OH, (4)Grote Enterprises, Cincinnati, OH*

2. Applying Model Predictive Control for Operational Carbon Emission Reduction of a Residential Building (OR-25-C115)

Pascal Strauch, Student[1] *and Weimin Wang, PhD, S-B-a Member*[2], *(1)Karlsruhe Institute of Technology, Karlsruhe, Germany, (2)University of North Carolina, Charlotte, Charlotte, NC*

3. Synergies Towards Achieving Low Energy Residential Buildings: A Comparative Case between the UK and Kingdom of Saudi Arabia KSA (OR-25-C116)

Amr Suliman, PhD, Full Member[1], *Mahroo Eftekhari, CEng, Full Member*[2], *Thomas Steffan*[3], *Faris Almaziad*[4], *Noman Ashraf*[4], *Badran Alzenifeer*[4] *and Khalid Alshaibani*[4], *(1)University of Oxford, Loughborough, United Kingdom, (2)Loughborough University, GB-Loughborough, Leicestershire, United Kingdom, (3)Loughborough University, Loughborough, United Kingdom, (4)Imam Abdulrahman Bin Faisal University, Damam, Saudi Arabia*

4. Leveraging Household Participation to Achieve Demand-Side Management and Decarbonization Goals in Residential Buildings in the U.S (OR-25-C117)

Patricia Guillante, Student[1], *Jordan Hofbauer*[1] *and Kristen Sara Cetin, PE, Full Member*[2], *(1)Michigan State Univerisity, East Lansing, MI, (2)Michigan State University, EAST LANSING, MI*

5. Residential Home Decarbonization Using Advanced Micro-CHP (OR-25-C118)

Zhiming Gao, Oak Ridge National laboratory, Full Member[1], *Philip Zoldak*[2], *Molana Maysam, Enginuity Power Systems*[2] *and Jacques Beaudry-Losique*[2], *(1)Oak Ridge National Laboratory, OAK RIDGE, TN, (2)Enginuity Power Systems*

11:00 AM - 12:30 PM

Paper Session 27

Artificial Intelligence in Energy Efficiency and Generation

Track: Fundamentals and Applications

NY PDH

Room: Orange F

Chair: Ahmed Elatar, Oak Ridge National laboratory, Associate, Oak Ridge National Laboratory, OAK RIDGE, TN

This session incorporates various networks and models of machine learning to improve energy efficiency, share synthetic daily profiles of energy consumption data, and enhancing reliability and efficiency in wind power integration into energy grid.

1. Probabilistic Power Demand Forecasting Using Bayesian Additive Regression Trees in Residential Building (OR-25-C119)

Bowen Yang*, Mustafa Gül and Yuxiang Chen, University of Alberta, Edmonton, AB, Canada*

2. Building HVAC Optimal Control: A Practical Reinforcement Learning Framework Based on Physics-Informed Machine Learning (OR-25-C120)

Xuezheng Wang, Student *and Bing Dong, Ph.D., S-B-a Member, Syracuse University, SYRACUSE, NY*

3. Synthetic Data Generation of Energy Use and Thermal Condition in a Residential Building Via Generative Adversarial Networks (GAN's) (OR-25-C121)

Ahryman Seixas Busse B Nascimento, Ph.D. *and Louis Gosselin, P.Eng., Ph.D., S-B-a Member, Universite Laval, Quebec City, QC, Canada*

11:00 AM - 12:30 PM

Paper Session 28

IAQ / Ventilation

Track: Fundamentals and Applications

Room: Orange G
Chair: Jubair A. Shamim, Oak Ridge National Laboratory, Full Member, Oak Ridge National Laboratory, OAK RIDGE, TN
This session presents multiple studies in indoor air quality and ventilation, going through air purification systems, filtration and improving the overall air quality.

1. Understanding PCO Air Purification Systems (OR-25-C124)
***Lukasz Sztaberek, PhD, S-B-a Associate**, NYC College of Technology, Brooklyn, NY*

2. Polymeric Bioactive Filtration for HVAC Systems (OR-25-C125)
***Thomas J. Kennedy III, Mr., Full Member**, Industrial Polymers and Chemicals, Inc., Shrewsbury, MA*

3. Zero Carbon New-Construction Codes: Impacts on Criteria Pollutants in New York (OR-25-C126)
***Jim Edelson, Associate**[1], Jodi Smits Anderson, FAIA[2], Grant Seely[2] and Tristan E Grant, Member[2], (1)Consultant, SNOHOMISH, WA, (2)New Buildings Institute, PORTLAND, OR*

4. Enhancing Air Hygiene in the Breathing Zone to Mitigate Aerosol Transmission in Hospital Environments through Additional Air-Sanitizing Devices (OR-25-C127)
***Tong Lin, Associate**[1], Mezong Jamir[1], Thomas Dunbar, Member[2] and Jianshun Zhang[3], (1)Syracuse University, SYRACUSE, NY, (2)tomPhyzx.LLC, Dundee, NY, (3)Syracuse University, Syracuse, NY*

5. Impact of Portable Generator Shutoff Strategies on CO Production and Resulting Cohb Profiles (OR-25-C128)
***Stephen Zimmerman, Associate** and Steven J Emmerich, MSME, Fellow Member, NIST, GAITHERSBURG, MD*

11:00 AM - 12:30 PM

Seminar 43 (Intermediate)

LIVESTREAM: Alternative Fuel or Waste Heat Driven Heat Pump or Cooling Systems

Track: Pathways to Building Decarbonization

Room: Orlando V
Sponsor: 8.3 Absorption and Heat Operated Machines, 1.10 Combined Heat and Power Systems
Chair: William A Ryan, PhD, Fellow S-B-a Member, University of Illinois at Chicago, CHICAGO, IL
This seminar covers information on any absorption or other heat operated system used for cooling and/or heating, for domestic hot water, space conditioning or industrial applications, and how these technologies can use waste heat, solar heat, gaseous or liquid biofuels, hydrogen or other options to aid in the carbon transition. Presentations may include but not limited to: Current Equipment Developments, Analysis Procedures, Research and Policy Issues, Case Studies and Simulation Studies, or Source Efficiency and Carbon Emission Studies

1. Recent Advancements in Ionic Liquid Absorption Dehumidification for Energy Efficient Treatment of Ventilation Air
***Saeed Moghaddam, Ph.D., Full Member**, University of Florida, GAINESVILLE, FL*

2. Decarbonizing with Absorption: Alternative Fuels and Waste Heat
***Ellen Makar**, Energy Concepts LLC, Annapolis, MD*

3. Industrial Cascade Absorption Refrigeration Units
***G Anand, PhD, Full Member**, Energy Concepts LLC, Annapolis, MD*

4. Is It Getting Hot in Here? How Gas Heat Pumps and Renewable Natural Gas Work Together to Decarbonize Building Heating
***Michael A Garrabrant, Full Member**, Stone Mountain Technologies, Johnson City, TN*

11:00 AM - 12:30 PM

Seminar 44 (Intermediate)

In-Situ Resource Utilization for Lunar Habitats: Implications on Habitat Environments

Track: Industrialized Construction: Opportunities and Challenges

Room: Orlando VI
Sponsor: TC 9.13 Space
Chair: Arup Bhattacharya, Ph.D., Associate, Louisiana State University, BATON ROUGE, LA

This presentation examines sustainable construction materials for Earth and space, focusing on in situ resources like regolith, sulfur and basalt for automated construction of extraterrestrial habitats, essential for long-term space exploration. It highlights the thermal conductivity and energy performance of these materials. Waterless construction 3D printing (C3DP) with sulfur concrete and its thermal behavior during printing will be emphasized. The seminar explores modeling the thermal performance of molten sulfur using heuristic and learning-based models to predict spatiotemporal temperature distribution and optimize structural performance. Finally, it outlines the expected thermal environment in a simulated lunar habitat under lunar environment conditions.

1. In-Situ Resource Utilization for Lunar Habitats: Implications on Habitat Environments - Part 1
***Ehsan Kamel, Ph.D., CEM, S-B-a Associate**, New York Institute of Technology (NYIT), NY*

2. In-Situ Resource Utilization for Lunar Habitats: Implications on Habitat Environments - Part 2
***Alain Boldini, PhD**, New York Institute of Technology, Long Island, NY*

3. In-Situ Resource Utilization for Lunar Habitats: Implications on Habitat Environments - Part 3
***Arup Bhattacharya, Ph.D., Associate**, Louisiana State University, BATON ROUGE, LA*

11:00 AM - 12:30 PM

Seminar 45 (Intermediate)

Unitary Equipment Rating and Testing: Updates and Perspectives

Track: HVAC&R Systems and Equipment

NY PDH G

Room: Orange A

Sponsor: 8.11 Unitary and Room Air Conditioners and Heat Pumps, TC 8.1

Chair: Allen C Kirkwood, Full Member, Carrier Corporation, Indianapolis, IN

Rating and testing procedures of residential, commercial and industrial unitary air-conditioning and heat pump equipment are undergoing major changes to align with newer technologies including cold-climate heat pumps, digital compressors, integrated economizers and advanced controllers, among others. This seminar covers the recent modifications to AHRI 210/240, proposed standards AHRI 1600 and AHRI 1340 as well as updates on field-testing and load-based testing procedures for next-generation equipment rating. The presentations delve into the unique challenges and improvements presented by each standard and offer perspectives on viable pathways to redefine the future of equipment performance rating.

1. What Are IVEC and IVHE?
***Kevin Teakell, P.E., Full Member**, AAON, Inc, Tulsa, OK*

2. New Central AC/HP Efficiency Descriptors in AHRI 1600: Score and SHORE
***Wongyu Choi, Ph.D., Full Member**, Christopher Stone, Member and Austin Kim, Member, AHRI, Arlington, VA*

3. Next-Generation Heat Pump and Air Conditioner Rating Based on Load-Based Testing
***James E Braun, Ph.D., Fellow Life Member**[1], Jie Ma, Ph.D., Full Member[2], William Travis Horton, Ph.D.[3], Dohyeon Kim[4] and Parveen Dhillon, Associate[5], (1)Purdue University, W LAFAYETTE, IN, (2)Purdue University, West Lafayette, IN, (3)Center for High Performance Buildings, Purdue University, West Lafayette, IN, (4)Purdue University - Ray W. Herrick Laboratories, West Lafayette, IN, (5)National Renewable Energy Lab (NREL), W Lafayette, IN*

4. Comparing M1, SPE07 and Field Performance for Six Variable Speed Heat Pumps
***David P Yuill, PE, S-B-a Member**, University of Nebraska, LINCOLN, NE*

11:00 AM - 12:30 PM

Workshop 4 (Basic)

Practical Application of Guideline 13-2024-Specifying Building Automation Systems; Control Systems Network Architecture Design and Integration

Track: Artificial Intelligence, Building Automation and Controls

NY PDH G

Room: Orange B

Sponsor: 1.4 Control Theory and Application, 7.5 Smart Building

Chair: Taraneh Shoorideh, Full Member, P2S Inc, Long Beach, CA

ASHRAE RELEASE 2024 UPDATE OF GUIDELINE 13 - SPECIFYING BUILDING AUTOMATION - After 9 years of work, this update has provides significant advancements to designers, specifiers, and implementers of building control systems. Learn the fundamentals of designing a well-integrated building controls systems today while preparing for AI, Machine Learning, advanced cybersecurity and advanced user interface requirements. This workshop provides the audience with a new approach to

BAS design and will engage the audience in lively discussion about industry trends, use cases and integration/implementation objectives. Learn from industry experts about best practices and innovative solutions to modernize your building automation infrastructure.

1. Modernizing Building Automation with ASHRAE Guideline 13: Specifications, Resources and Trends
Todd Gottshall, Director of Engineering, Full Member[1]*,* ***Christopher Battisti, PE, Associate***[2]*,* ***Brian Clark***[3] *and Ron Bernstein, Full Member*[4]*, (1)Western Allied Mechanical, Emerald Hills, CA, (2)USACE HQ, Kansas City, MO, (3)U.S. Army Corps of Engineers, Champaign, IL, (4)RBCG Consulting, Encinitas, CA*

1:30 PM - 3:00 PM

AHR Expo Session 3 (Intermediate)

Design of Non-Structural Systems for Extreme Weather Disasters

Track: Future-Proofing the Built Environment
Room: W310
Sponsor: 2.7 Seismic, Wind and Flood Resistant Design
Chair: Harold J Dubensky, P.E., Life Member, AAON, Inc., Tulsa, OK
The presentations in this Seminar address the design, maintenance and operation of critical equipment that may be needed during a flooding event, as well as the status of current regulations and codes associated with flooding. They will also provide the risk and costs of not planning and designing HVAC&R equipment and systems to withstand major events. In addition, the session provides lessons learned from major hurricanes regarding resilient design of HVAC&R equipment, and how hurricanes have led to the adoption of the State Building Codes.

1. Fukushima Daiichi Nuclear Disaster
James A Carlson, P.E., Fellow Life Member*, Seismic Source Int, Springfield, NE*

2. Design for Extreme Weather Lessons Learned from Recent Hurricane Seasons
Robert E Simmons, PE, Full Member*, Petra Seismic Design LLC, Houston, TX*

3. How Hurricanes Have Transformed Building Codes
Harold J Dubensky, P.E., Life Member*, AAON, Inc., Tulsa, OK*

1:30 PM - 3:00 PM

Seminar 46 (Intermediate)

LIVESTREAM: Decarbonizing in Very-Cold Climates: Latest on Field and Modeling Efforts to Retrofit Communities in Extreme Climates

Track: Pathways to Building Decarbonization

NY PDH G

Room: Orlando V
Sponsor: 4.7 Energy Calculations
Chair: Kristen Sara Cetin, PE, Full Member, Michigan State University, EAST LANSING, MI
Weatherization and building electrification reduce carbon emissions and support a sustainable and just energy transition. However, electrification and weatherization can produce adverse effects if not planned carefully. This challenge is further complicated by locations where temperatures are extremely cold. It is important to have the right modeling tools and case studies. This seminar presents two case studies in very cold climate zones in Colorado and Alaska. Presentations describe both community engagement, instrumentation and modeling efforts with the end goal of weatherization and/or electrification and a workflow that we have developed to study the potential effects of electrification and weatherization.

1. Community-Scale Electrification As a Path to Decarbonize Our Communities: Preliminary Results and Lessons Learned
Paulo Cesar Tabares Velasco, PhD, S-B-a Member*, Colorado School of Mines, GOLDEN, CO*

2. A Community-Scale Workflow for Evaluating Benefits from Electrification
Karlyle Dais Munz, Student*, Colorado School of Mines, GOLDEN, CO*

3. Collection of Energy Data in Communities in Alaska
Patricia Guillante, Student*, Michigan State Univerisity, East Lansing, MI*

Tuesday, February 11, 3:15 PM - 4:45 PM

Seminar 47 (Intermediate)

LIVESTREAM: ASHRAE IAQ Mythbusters: Debunking Misconceptions about ASHRAE Policy and Standards with Expert Insights

Track: Ventilation and Indoor Environmental Quality

Room: Orlando V

Chair: Marwa Zaatari, PhD, Full Member, D Zine Partners, Austin, TX

This seminar offers an engaging seminar designed to clarify and challenge misconceptions surrounding key ASHRAE Standards. Focusing on ASHRAE Standards 62.1, 62.2, 170, and 241, the session addresses critical topics including health, ventilation rates, filtration and air cleaning, CO_2 and unvented combustion. Expert panelists will explore and demystify prevalent myths, providing clear insights into the practical applications and intentions of these standards. Attendees will gain valuable understanding and actionable knowledge for effectively navigating and implementing ASHRAE guidelines.

1. ASHRAE IAQ Standards Must Not Address Health – Wrong!
***William P Bahnfleth, Ph.D., P.E., Presidential Fellow Life SBA Member**, The Pennsylvania State University, State College, PA*

2. Home Mythbusters: Uncovering the Secrets of ASHRAE Standard 62.2
***Max Sherman, Ph.D., Fellow Life Member**, ASHRAE, Moraga, CA*

3. Healthcare Clarity: Demystifying ASHRAE Standard 170
***Travis R English, P.E., Full Member**, Kaiser Permanente*

4. Air Cleaning Face-Off: Myth-Busting for Safety and Effectiveness
***Marwa Zaatari, PhD, Full Member**, D Zine Partners, Austin, TX*

5. Unveiling the Truth about CO2
***Josephine Lau, PhD, S-B-a Member**[1] and Pawel Wargocki, Dr., Fellow Member[2], (1)Univ of Nebraska-Lincoln, LINCOLN, NE, (2)DTU Environ and resource Eng-Tech Univ of Denmark, Kongens Lyngby, Denmark*

Tuesday, February 11, 3:30 PM - 4:30 PM

AHR Expo Session 4 (Intermediate)

Cutting-Edge Japanese Technologies on Energy Storage: SHASE Annual Award Winners

Track: Energy Storage and Grid Resiliency

Room: W310

Chair: Katsunori Nagano, Professor, Hokkaido University, Sapporo, Japan

Integration of energy storage in HVAC systems levels peak energy demand and flexibility for shedding and shifting building loads. In this seminar, design and operation methodologies with energy storages for two office buildings are presented. The first building has a thermal energy storage and hydrogen cogeneration system that replaces and stores surplus power from solar power generation. Another building is a medium-sized building with a water thermal storage system aged over 40 years old, focusing on the renovation methods, efficiency improvements using water thermal storage, and demand response.

1. Energy-Saving Office That Uses Both Thermal Energy Storage and Electrical Energy Storage Using Hydrogen
***Yasuyoshi Amada, Mechanical&Electrical design, HBDP**, Shimizu Corporation, Tokyo, Japan*

2. Renovation ZEB Using Existing Water Thermal Storage and Initiatives for Electricity Demand Leveling
***Daisuke Kuboi** and Hiroki Miyajima, Tokyo Electric Power Company Holdings, Inc., Tokyo, Japan*

Wednesday, February 12

Wednesday, February 12, 8:00 AM - 9:30 AM

Paper Session 29

Integrating Salt Hydrate Thermochemical Energy Storage for Buildings Heating and Cooling Applications

Track: Fundamentals and Applications

Room: Orange E

Chair: Daniel L. Villa, PE, Full Member, Sandia National Laboratories, ALBUQUERQUE, NM
The integration of thermal energy storage systems with building heating and cooling systems can reduce peak thermal loads, improve energy efficiency, and allow optimal use of intermittent renewable energy such as wind and solar. Thermochemical energy storage utilizes the energy in chemical bonds to achieve relatively high energy density and minimal losses during storage periods. Papers in this session present various applications of salt hydrate thermochemical energy storage to save energy and tailor peak demand. A paper also elaborates on the ionocaloric effect and the challenges related to material selection in the ionocaloric heat pump.

1. Component Level Investigation of Salt Hydrate Thermochemical Energy Storage for Buildings (OR-25-C129)
***John Anthony R Steinbergs, Student**, Brian M Fronk, Full Member and Jumman Al Jawad, The Pennsylvania State University, University Park, PA*

2. Novel Designs and Simulations of Integrating Thermochemical Energy Storage Systems for Residential Heating Applications (OR-25-C130)
***Xiaoou Hu, Student**, Yao Yu, Ph.D., BEAP and BEMP, Associate, Xuelei Xiao, Student, Adam Gladen, Ph.D and Shishir Kumar Das, North Dakota State University, FARGO, ND*

3. Comparative Analysis of Energy Storage Systems for Residential Space Heating: Thermochemical Salt Vs. Water-Based Systems (OR-25-C131)
***Xuelei Xiao, Student**, Xiaoou Hu, Student, Shishir Kumar Das, Yao Yu, Ph.D., BEAP and BEMP, Associate and Adam Gladen, Ph.D, North Dakota State University, FARGO, ND*

4. 'ionocaloric Effect' Evaluation of Mixing Ethylene Carbonate with Two Different Salts (OR-25-C132)
***Mateo Roldan-Carvjal, M.Eng., Student**[1], Jinwoo Oh, Ph.D., Affiliate[2], Zhichen Guan[3], Riley B Barta, PhD, Associate[2], Davide Ziviani, PhD, Full Member[4] and David Warsinger, Ph.D.[4], (1)Purdue University, W LAFAYETTE, IN, (2)Purdue University, West Lafayette, IN, (3)Grinnell College, Grinnell, IA, (4)Purdue University - Ray W. Herrick Laboratories, West Lafayette, IN*

5. Development of Phase-Change Material Based Off-Peak Thermal Energy Storage System for Building Space Cooling (OR-25-C133)
***Shubham Jitendra Sathe, Graduate Student**[1], Sarath Kannan, Engineer[2], Milind A Jog[1] and Raj M Manglik, Professor, Fellow S-B-a Member[1], (1)University of Cincinnati, CINCINNATI, OH, (2)GTI Energy, Des Plaines, IL*

8:00 AM - 9:30 AM
Paper Session 30

Heat Pumps

Track: Fundamentals and Applications

Room: Orange F
Chair: Landan Taylor, National Renewable Energy Laboratory, Golden, CO and Grant Wheeler, Member, National Renewable Energy Laboratory, Golden, CO
With the increased electrification of buildings, more efficient heat pump equipment is necessary. This session looks at both heat pump equipment design and applications.

1. Enhancing Options for Residential Decarbonization: A Cooling Efficiency and Indoor Comfort Evaluation for a Mid-Efficiency Inverter Heat Pump (OR-25-C134)
*Mingjun Wei, Student[1], **Zhiyao Yang, Ph.D., Associate**[1], Zheng O'Neill, Ph.D., P.E., Fellow Member[2] and Daniel Nie[3], (1)Texas A&M University, COLLEGE STATION, TX, (2)Texas A&M University , College Station, TX, (3)Texas A&M University, College Station, TX*

2. Lab Evaluation and Modeled Savings of a Tri-Function (space heating, cooling, and DHW) Air to Water Heat Pump System (OR-25-C135)
***Jason J LaFleur, Full Member**[1], Ken D Hultquist, Associate[1], Alejandro Baez Guada, Associate Member[1], Ramanathan Dharmarajan, Principal Engineer, Associate[1], Jessica Komar[1] and Jutae Hong[2], (1)GTI Energy, Des Plaines, IL, (2)Daikin Comfort Technologies, Houston, TX*

3. Right-Sizing Heat Pumps: The Art and Science of Optimal Sizing for Comfort and Efficiency (OR-25-C136)
***Mohammadhasan Fathollahzadeh, Ph.D., BEMP**, Rewiring America*

4. Performance Evaluation of Heat Pump Rooftop Units for Advancing Commercial Building Electrification (OR-25-C137)
***Parveen Dhillon, Associate** and Grant Wheeler, Member, National Renewable Energy Laboratory, Golden, CO*

5. Laboratory and Field Demonstration of a Gas Absorption Heat Pump for Commercial Building Space Conditioning (OR-25-C138)
*Arjun Thirumaran, Associate, Jason J LaFleur, Full Member, Alejandro Baez Guada, Associate Member, Lee Van Dixhorn and **Farzin M Rad, PhD, P.Eng, Full Member**, GTI Energy, Des Plaines, IL*

8:00 AM - 9:30 AM

Paper Session 31

HX Coil and Condensation

Track: Fundamentals and Applications
Room: Orange G
Chair: Paul A Torcellini, P.E., Fellow Member, NREL, LAKEWOOD, CO, United States and Nicholas L Long, PE, Full Member, NREL, LAKEWOOD, CO, United States
.

1. Discussion on Condensate Temperature from Wet Surface Coil (OR-25-C139)
*Jian Yu, Full Member and **Tyler Stusynski, Full Member**, Super Radiator Coils, Richmond, VA*

2. Experimental Investigation of V-Shaped Coil Bank Performance (OR-25-C140)
***Jian Yu, Full Member**, Super Radiator Coils, NORTH CHESTERFIELD, VA*

3. Airflow Distribution Alongside the Cold Aisle with Non-Uniform Heat Load (OR-25-C141)
*Jao Yi-Chen and **Chi-Chuan Wang**, National Yang Ming Chiao Tung University, Hsinchu, Taiwan*

4. A Study on Cumulative Freezing Prevention Structure of Heat Pump System (OR-25-C142)
***Junghoon HA**[1], Jiwon Jang Sr.[1], Dongsoo Moon[1], Jungtack Lee[1], Sunwoo Kim[2], Juhyok Kim[1] and Simwon Chin[1], (1)LG ELECTRONICS INC., Changwon-si, Gyeongsangnamdo, Korea, Republic of (South), (2)UNIVERSITY OF ALASKA FAIRBANKS, Fairbanks, AK*

5. Numerical Study of Near-Isothermal Liquid Piston Compression with a Liquid Droplet Injection Using Unsteady Reynolds-Averaged Navier-Stokes Coupled with Lagrangian-Eulerian Model (OR-25-C143)
***Thien Nguyen, Senior R&D Staff**[1], Joseph D Rendall, Associate R&D Staff, Associate[1] and Stephen Kowalski, Full Member[2], (1)Oak Ridge National Lab, Oak Ridge, TN, (2)Oak Ridge National Lab, Farragut, TN*

8:00 AM - 9:30 AM

Seminar 48 (Intermediate)

Casting a Wider Net: Future-Proofing to Meet AEC Industry's Talent Demands

Track: Future-Proofing the Built Environment

NY PDH

Room: Orange A
Sponsor: 7.3 Operation, Maintenance and Cost Management, 7.5 Smart Building Systems , College of Fellows
Chair: Filza H Walters, MBA, FESD, FASHRAE, Fellow S-B-a Member, Texas A&M University, COLLEGE STATION, TX
Academic programs provide engineering students with vital technical expertise and core competencies essential for success in a dynamic professional landscape. Diverse backgrounds and perspectives foster innovation, creative dialogue and problem-solving. Technical skills, combined with teamwork, communication and critical thinking, enhance market differentiation. Effective recruitment practices, academic preparedness and inclusive company culture are crucial. Identifying and addressing skills and knowledge gaps through re-skilling and lifelong learning strengthens the workforce. Talent development will be explored through young engineers, educators, and industry experts. Sharing best practices will prepare future generations to be "future-ready" and meet HVAC and building sciences industry demands.

1. Developing a Talent Pipeline By Cultivating and Celebrating ASHRAE and CIBSE's Youngest Members
***Erato Vasileiou, Director, Sustainable Operations, Client Lead, JLL, CIBSE YEN Global Immediate Past Chair, WELL AP, BREEAM Assessor, AssessFitwell Ambassador**, JLL, London, United Kingdom*

2. Competency Based Models for a Future Ready Workforce
***Filza H Walters, MBA, FESD, FASHRAE, Fellow S-B-a Member**, Texas A&M University, COLLEGE STATION, TX*

3. Navigating Career Pivots in Multiple Industries to Propel Projects and Clients Forward
***Catherine A Tinkler, EBCP, PMP, LEED AP O+M, Associate**, Page Southerland Page, Inc., Weston Lakes, TX*

4. Creating Smart Building Content to Retool and Educate Tomorrows Workforce
***Xiaohui Zhou, PhD, CEM PE, Full Member**, Slipstream, Madison, WI*

8:00 AM - 9:30 AM

Seminar 49 (Intermediate)

Diluting the Dangers Within: Applying and Validating Demand Control Ventilation

Track: Ventilation and Indoor Environmental Quality

Room: Orange B
Sponsor: 9.10 Laboratory Systems, 1.4 Control Theory and Application
Chair: Ryan Soo, Associate, Siemens, Chicago, IL
Ventilation is a major driver of energy use within buildings, more so in laboratory environments where higher ventilation rate is used to dilute and extract hazards to keep researchers safe. This situation has huge energy savings potential by using demand control ventilation strategies to match ventilation rates with the risks within laboratory environments. In this seminar, we explore the application and validation of demand control ventilation to ensure the safety of laboratory occupants.

1. Methods to Specify and Validate Performance of Demand Control Ventilation in Labs and Critical Workspaces
***Thomas C Smith, Full Member**, 3Flow, Cary, NC*

2. The Significance of Demand Control Ventilation for Laboratories
***Kishor K Khankari, PhD, Fellow Member**, AnSight LLC, Ann Arbor, MI*

3. Demand Based Ventilation to Reduce Energy Use Intensity (EUI)
***Tyler W Kee, Associate**, Phoenix Controls*

8:00 AM - 9:30 AM

Seminar 50 (Intermediate)

Driving Building Decarbonization with Personalized Environmental Control Systems (ANNEX 87)

Track: Pathways to Building Decarbonization

Room: Orange C
Sponsor: 2.1 Physiology and Human Environment
Chair: Shichao Liu, Full Member, Worcester Polytechnic Institute (WPI)
This seminar delves into the crucial role of Personalized Environmental Control Systems (PECS) in the decarbonization of buildings and enhancement of Indoor Environmental Quality (IEQ). Presentations cover the energy and comfort benefits of PECS, showcasing their potential in reducing carbon footprints while improving occupant satisfaction. Topics include the innovative applications of PECS in various settings, key performance indicators for their evaluation and cutting-edge dynamic and wearable technologies. Insights from international ANNEX 87 highlight how these systems can empower individuals, fostering a sustainable and resilient built environment aligned with ASHRAE's strategic goals.

1. IEA-EBC Annex 87 Energy and Indoor Environmental Quality Performance of Personalised Environmental Control Systems (PECS)
***Bjarne Wilkens Olesen, Professor, Presidential Fellow Life Member**, ICIEE-DTU, Kongens Lyngby, Denmark*

2. Personal Comfort Systems: Unleashing Their Potential in Decarbonizing the Building Stock
***Wilmer Pasut, PhD, Associate**, University of Venice*

3. Evaluating Personal Environmental Control Systems (PECS) Using Key Performance Indicators (KPIs)
***Joyce Kim, Full Member**, University of Waterloo*

4. PECS – Empowering Occupants Towards Enhanced IEQ in Their Micro-Environments
***Chandra Sekhar, PhD, Fellow Member**, National University of Singapore, Singapore, Singapore*

5. Empowering Everyday Comfort: Exploring the Promise of Dynamic and Wearable PECS Technology
***Shichao Liu, Full Member**, Worcester Polytechnic Institute (WPI)*

8:00 AM - 9:30 AM

Seminar 51 (Intermediate)

LIVESTREAM: Latest Updates on Measurement of Low GWP Refrigerants and other Working Fluid Thermophysical Properties

Track: Fundamentals and Applications

Room: Orlando V
Sponsor: 1.1 Thermodynamics and Psychrometrics, 1.2 Instruments and Measurements , MTG.LowGWP, TC 1.3
Chair: Vikrant C Aute, Ph.D., Fellow Member, University of Maryland, COLLEGE PARK, MD

Refrigerants, oils and glycol mixtures are often referred to as the life-blood of HVAC&R systems. Furthermore, phase change materials (PCMs) used in thermal storage systems are gaining attention, as they complement HVAC&R systems to improve grid-resiliency. Characterizing thermophysical properties such as relationships between temperature, pressure, density, viscosity, etc. is critical for design of HVAC systems to ensure necessary performance, control, and safety. These measurements are particularly important for lower-global warming potential refrigerants being considered to reduce emissions. This session presents the latest research on thermophysical properties of new refrigerants including HFOs, oil mixtures and PCMs.

1. From Accurate Viscosity Measurements to Wide-Ranging Viscosity Formulations
***Sebastian Herrmann, Ing, Associate**, Zittau/Goerlitz University of Applied Sciences, Zittau, Germany*

2. Developments of Helmholtz Energy Equations of State for Low GWP Refrigerants
***Ryo Akasaka, PhD**, Kyushu Sangyo University, Fukuoka, Japan*

3. Measurements and Empirical Models of Transport Properties of Low GWP Refrigerants
***Akio Miyara, PhD, Full Member**, Saga University, Saga Shi, Japan*

4. A Device to Measure the Foaming Characteristics of Refrigerant-Lubricant Mixtures
***Craig R Bradshaw, Member ASHRAE, Full Member**, Oklahoma State University, OKLAHOMA CITY, OK*

5. Current Status, Challenges, and Opportunities in State of Charge Measurements for Thermal Energy Storage Materials
***Joseph D Rendall, Associate R&D Staff, Associate**, Oak Ridge National Lab, Oak Ridge, TN*

8:00 AM - 9:30 AM

Seminar 52 (Advanced)

The Evolution Continues! CFD Must Continue to Enhance and Improve Its Underlying Algorithms to Meet Data Center and Ventilation Demands

Track: Fundamentals and Applications

NY PDH G

Room: Orlando VI

Sponsor: 4.10 Indoor Environmental Modeling, 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

Chair: Duncan Phyfe, Associate, Verdtantas, Holden, MA

CFD has been in use for over 50 years, but the technology must continue to improve for ventilation applications. This session explores the design and operation of data centers, focusing on cooling equipment capacity and Computational Fluid Dynamics (CFD) modeling. We will debunk misconceptions about “Fast Fluid Dynamics” efficiency, propose a model for estimating 3D flow resistance, and discuss the need for CFD to co-simulate with sub-models for accuracy. The session also covers the role of ventilation effectiveness in optimizing HVAC systems, presenting a numerical simulation procedure for assessment. Attendees will gain insights into data center complexities and solutions.

1. Recent Research in Data Center CFD: Solver Algorithms and Distributed Resistances
***James W VanGilder, PE, Full Member**, Schneider Electric, Andover, MA*

2. Extending CFD Algorithms By Connecting with Other Technologies
***Matthew Laurence Kaufeler, MEng, Full Member**, Cadence Design Systems, Wincanton, United Kingdom*

3. Accurately Modeling Chillers for Data Center CFD Simulations
***Mikhail Koupriyanov, P.Eng., M.A.Sc. P.Eng., Associate**[1] and **Oleksandr Shchuchkin**[2], (1)Price Industries Ltd., Winnipeg, MB, Canada, (2)Predict by Price, Winnipeg, MB, Canada*

Wednesday, February 12, 9:45 AM - 10:45 AM

Paper Session 32

Analysis via Future Weather Files

Track: Fundamentals and Applications
Room: Orange F
Chair: Sonya M Pouncy, CEM, LEED AP, Full Member, Building Vitals, Detroit, MI
.

1. Towards to Climate Change Adaptive Whole Building Energy Simulation Methods (OR-25-C146)
***Parisa Salehi, Student** and Aslihan Karatas, Associate, University of Illinois Chicago, Chicago, IL*

2. Comparing Typical Meteorological Year Data with New Weather Data Sets in Building Energy Analysis Under Climate Change (OR-25-C145)
Chan-hyung Shim, Student Member[1] *and Goopyo Hong, PhD, Full Member*[2]*, (1)Kangwon National University, Samcheok-si, Gangwon-do, Republic of Korea, Korea, Republic of (South), (2)Kangwon National University, Samcheok-si, Korea, Republic of (South Korea)*

3. The Relative Importance of Building Design Parameters in Reducing Energy Use and Sensible Heat Release from Buildings in Light of Forecasted Future Weather Data (OR-25-C144)
Mansour Alhazmi, Assistant Professor[1] *and* ***Jyothis Anand Prem Anand Jayaprabha, Ph.D., Student***[2]*, (1)King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia, (2)Oak Ridge National Laboratory, OAK RIDGE, TN*

9:45 AM - 10:45 AM

Paper Session 33

Expanding Retrofit Strategies

Track: Fundamentals and Applications
Room: Orange G
Chair: Aslihan Karatas, Associate, University of Illinois Chicago, Chicago, IL
.

1. Existing Building Decarbonization: Prioritization By Grid Emissions (OR-25-C148)
Coral Winona Pais, P.E., BEMP, Full Member *and* ***Jason A Majerus, P.E., Full Member****, DLR Group, Cleveland, OH*

2. Retrofit Solutions to Improve the Energy Performance of Existing Operational U.S Administrative Buildings (OR-25-C149)
Habib ArjmandMazidi, Assistant Professor, Student[1]*, Sajith Indika Wijesuriya, Postdoctoral Researcher, Associate*[2]*, Ravi Anant Kishore, PhD, Associate*[2]*, Chuck Booten, Research Engineer, Member*[3] *and Mario Medina, Dr.*[4]*, (1)Milwaukee School of Engineering, MILWAUKEE, WI, (2)National Renewable Energy Laboratory, WASHINGTON, DC, (3)National Renewable Energy Laboratory, Washington, DC, (4)Texas A&M University, College Station, TX*

9:45 AM - 10:45 AM

Seminar 53 (Intermediate)

Building Decarbonization: Policy Goals, Performance Standards and Pathways for Optimizing Both Climate and Health

Track: Pathways to Building Decarbonization

NY PDH G

Room: Orange A
Sponsor: 2.8 Building Environmental Impacts and Sustainability, TC 2.5
Chair: Janice K Means, PE, Fellow Life S-B-a Member, Retired from Lawrence Technological University, Southfield, MI
Climate policies in the building sector, such as building performance standards, typically focus on greenhouse gas emission reduction goals, while not directly including air pollutants that cause adverse health impacts in their design. While these policies have the potential to improve air quality and public health, a holistic approach is needed to account for all aspects, such as public health savings opportunities and minimizing unintended negative health impacts. This seminar aims to cover these aspects and provide recommendations for our decarbonization efforts.

1. How Difficult Will It be to Meet BPS Targets? Results of a Large-Scale Analysis
Amanda L. Webb, PhD, Full Member*, University of Cincinnati, CINCINNATI, OH*

2. Developing a Framework to Evaluate Building Decarbonization Pathways
Mohammad Heidarinejad, Ph.D., P.E., Full Member*, Illinois institute of Technology, CHICAGO, IL*

3. Quantifying Projected Health and Climate Co-benefits of Energy Conservation in the Built Environment
Parichehr Salimifard, Assistant Professor, Associate Member*, Oregon State, Corvallis, OR*

9:45 AM - 10:45 AM

Seminar 54 (Intermediate)

Developing a Standard for Space Explorations: Examining Current State of Knowledge

Track: Ventilation and Indoor Environmental Quality

Room: Orange B
Sponsor: TC 9.13 Space
Chair: Arup Bhattacharya, Ph.D., Associate, Louisiana State University, BATON ROUGE, LA
This seminar explores the evolution of standards for cabin and habitat air quality in space missions. Providing a comprehensive overview of the current state of knowledge by reviewing NASA and International Space Consortium standards, the session delves into the current state of knowledge on environmental control systems for extraterrestrial applications, examining how principles from ASHRAE standards on IAQ, energy and refrigerant safety apply in zero/microgravity environments. Finally, the presentations outline the necessity for a new indoor air quality standard tailored to support regenerative environmental control systems for human explorers and auxiliary systems in space.

1. Overview
***Evan Connell, PE, Full Member**, Optima Engineering, CHARLOTTE, NC*
2. IEQ for Space Exploration
***Arup Bhattacharya, Ph.D., Associate**, Louisiana State University, BATON ROUGE, LA*

9:45 AM - 10:45 AM
Seminar 55 (Intermediate)

Getting the Most Out of Humidification and Evaporative Cooling Systems

Track: HVAC&R Systems and Equipment

Room: Orange C
Sponsor: 5.11 Humidifying Equipment
Chair: Marlee Spiegelberg, Associate, Condair Ltd., Ottawa, ON, Canada
Humidification and evaporative cooling systems have advanced considerably in the past decade. Additionally, these systems are being applied in new ways to protect occupant health, reduce traditional cooling demands and aid in decarbonization. This session explores how you can get the most out of humidification and evaporative cooling systems. It will explore humidity and health, leveraging evaporative cooling for decarbonization and optimizing the performance of existing systems to obtain their maximum benefits and value.

1. A Good Compromise for IAQ, Energy Saving, and Maintenance (with Focus on Humidifiers)
***Raul Simonetti, OPMP, Full Member**, CAREL Industries SpA, Rescaldina, Italy*
2. Leveraging Adiabatic Technologies for Decarbonization and Humidity Control
***Nicholas M. Lea, P.Eng, LEED AP BD+C, Full Member**, Condair Ltd., Ottawa, ON, Canada*
3. Optimizing Isothermal (Steam) Humidifier Performance to Reduce Maintenance and Energy Usage
***Duncan Alan Curd, BSc., Full Member**, DriSteem, EDEN PRAIRIE, MN*

9:45 AM - 10:45 AM
Seminar 56 (Intermediate)

LIVESTREAM: The Human Contributions to IAQ and Net Carbon

Track: Pathways to Building Decarbonization

Room: Orlando V
Chair: Nancy M McClellan, M.P.H., CIH, CHMM, CIH, Full Member, American Industrial Hygiene Association - Vice-President, Falls Church, VA
In the calculations for net carbon, the human contribution and impact are currently not represented in the operational considerations. Human contributions of CO_2, as well as volatile organic compounds, particulate material and bioaerosols, also significantly impact indoor air quality and human health and performance. This session covers the sources, magnitude and potential solutions for the human contributions.

1. IAQ and Climate Change Solutions
***Luke C H Leung, PE, BEMP, Fellow Member**[1], **Linda D Lee, DrPH, Full Member**[2] and **Jo Norris, Affiliate**[3], (1)Skidmore Owings & Merrill, CHICAGO, IL, (2)Linda D Lee Healthcare Consultants, Austin, TX, (3)Carbon Reform, Newark, DE*

9:45 AM - 10:45 AM

Seminar 57 (Intermediate)

When IoT Devices Meet with Artificial Intelligence: Examples of Industry Research in STBE Journal Available to ASHRAE Members for Free

Track: Artificial Intelligence, Building Automation and Controls

Room: Orange E

Sponsor: ASHRAE STBE editorial board

Chair: Jeffrey D Spitler, PhD, PE, Fellow S-B-a Member, Oklahoma State Univ, Stillwater, OK

This seminar provides an overview of selected research papers from the STBE journal focusing on data analysis with machining learning and IoT devices. The speakers will first introduce a case study of data analysis and interpretable machine learning for HVAC predictive control. Then, applications of a building automation system (BAS)-integrated fault detection and diagnostics (FDD) tool using inverse data-driven models will be discussed. Finally, a comprehensive study of IoT-enabled measurements for FDD of residential HVAC systems will be presented. These are examples of cutting-edge technical information and case studies that ASHRAE members can access through the STBE articles.

1. Data Analysis and Interpretable Machine Learning for HVAC Predictive Control: A Case-Study Based Implementation

***Jianqiao Mao**, University of Birmingham, United Kingdom*

2. Deployment of Real-Time Building Automation System-Integrated Inverse-Model-Based Fault Detection and Diagnostics Algorithms

***Andre Markus, PhD Candidate, Student**, Carleton University, Ottawa, ON, Canada*

3. Automated Fault Detection and Diagnosis of Airflow and Refrigerant Charge Faults in Residential HVAC Systems Using Iot-Enabled Measurements

***Kevwe Andrew Ejenakevwe, Student**, university of oklahoma, NORMAN, OK*

9:45 AM - 10:45 AM

Forum 3 (Basic)

Use of New A2L Refrigerants in Cold Storage Applications

Track: Refrigeration and Refrigerants

Room: Orlando VI

Sponsor: Refrigeration Committee CPCC

Chair: Donald L Brandt, Fellow Life Member, Retired, Phoenix, AZ

With the elimination of the of R-134a and R-404a because of high GWP values, the new A2L refrigerants with lower GWP values are becoming the standard for new/retrofit designs in the refrigerated storage applications. This is an open discussion with consulting engineers, contractors, owners and operators involved in the refrigerated storage business.

Wednesday, February 12, 11:00 AM - 12:30 PM

Paper Session 34

Cold-Climate Heat Pump

Track: Fundamentals and Applications

Room: Orange C

Chair: Sonya M Pouncy, CEM, LEED AP, Full Member, Building Vitals, Detroit, MI

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1. Development of Nearly Zero-Waste and High Performance Control Strategy Applied to the Cchp System (OR-25-C150)

***Juneyeol Jung, Student**[1], Sangwook Lee, Student[2] and Hoseong Lee[1], (1)Korea University, Seoul, Korea, Republic of (South), (2)Korea university Optimized Energy Conversion Systems Lab, Seoul, Korea, Republic of (South)*

2. Feasibility of Absorption Heat Pumps in Cold Climates Considering Performance and Greenhouse Gas Emissions Using Trnsys Simulations (OR-25-C151)

*Tahmid Ibn Sayeed, Student[1], **Melanie Fauchoux, PhD, Full Member**[1], Albin Joseph[1], Samira Payan[2] and Carey J Simonson, Fellow S-B-a Member[1], (1)University of Saskatchewan, Saskatoon, SK, Canada, (2)University of Sistan and Baluchestan, Zahedan, Iran (Islamic Republic of)*

3. Validation and Evaluation of Existing Cold-Climate Heat Pump Models in Energyplus Using Laboratory Data (OR-25-C152)
Rohit Jogineedi, PhD, Associate[1], *Alex Fridyland, Ph.D., Associate Member*[2] *and Alejandro Baez Guada, Associate Member*[3], *(1)GTI Energy, Davis, CA, (2)Gas Technology Institute, Chicago, IL, (3)GTI Energy, Des Plaines, IL*

4. Analysis of Cold Climate Performance of Residential Heat Pump: Field Test in Fairbanks, Alaska (OR-25-C153)
Nick Samuel[1], ***Sunwoo Kim***[1], *Junghoon HA*[2], *Jiwon Jang Sr.*[2], *Changsoo Shin*[2], *Simwon Chin*[2], *Dongsoo Moon*[2], *Chinhyuk Chang*[2] *and Sungwoo Song*[2], *(1)UNIVERSITY OF ALASKA FAIRBANKS, Fairbanks, AK, (2)LG ELECTRONICS INC., Changwon-si, Gyeongsangnamdo, Korea, Republic of (South)*

11:00 AM - 12:30 PM

Paper Session 35

Artificial Intelligence 2

Track: Fundamentals and Applications
Room: Orange E
Chair: David F Shipley, Full Member, Posterity Group, Ottawa, ON, Canada
.

1. A Framework Design of Transfer Reinforcement Learning (TRL) for Cooling Water System Optimization (OR-25-C155)
Zhechao Wang, Research Assistant, Student[1] *and Zhihong Pang, Assistant Professor, Associate*[2], *(1)Louisiana State University, BATON ROUGE, LA, (2)Louisiana State University , BATON ROUGE, LA*

2. HVAC Soft-Fault Impact Analysis: Data-Driven Fault Detection and Diagnostic-Augmented Energy Savings through Virtual and Thermal Meter Approaches (OR-25-C156)
Andre Markus, PhD Candidate, Student[1], *Brodie William Hobson, Associate*[2], *Jayson F Bursill, Ph.D, P.Eng., S-B-a Member*[3] *and Burak Gunay, Associate*[1], *(1)Carleton University, Ottawa, ON, Canada, (2)Natural Resources Canada (NRCan), Ottawa, ON, Canada, (3)Delta Controls Inc., Gloucester, ON, Canada*

3. Building Dynamic Modeling with a Seq2Seq Physical Incorporated Neural Network (OR-25-C157)
Zixin Jiang, Student *and Bing Dong, Ph.D., S-B-a Member, Syracuse University, SYRACUSE, NY*

4. Differential Predictive Control Framework for Optimal Scheduling of EV-Integrated Homes (OR-25-C158)
Yuewei Li, Student*, Xuezheng Wang, Student and Bing Dong, Ph.D., S-B-a Member, Syracuse University, SYRACUSE, NY*

5. Fuzzy Control Strategies and Intelligent Heat Demand Forecasting for District Heating System Plant Operation (OR-25-C159)
Ivan Ciric[1], *Marko Ignjatovic*[1] *and Stevica Cvetkovic*[2], *(1)Faculty of Mechanical Engineering, University of Niš, Niš, Serbia, (2)Faculty of Electronic Engineering, University of Nis, Nis, Serbia*

11:00 AM - 12:30 PM

Paper Session 36

Decarbonization 2

Track: Fundamentals and Applications
Room: Orange F
Chair: Daniel L. Villa, PE, Full Member, Sandia National Laboratories, ALBUQUERQUE, NM
.

1. Quantifying Office Building HVAC Marginal Operating Carbon Emissions and Load Shift Potential: A Case Study in California (OR-25-C160)
Aoyu Zou, Student[1], *Carlos Duarte, Ph.D., Associate*[2] *and Stefano Schiavon, PhD, Full Member*[3], *(1)UC Berkeley, Berkeley, CA, (2)UC Berkeley, Center for the Built Environment, Berkeley, CA, (3)University of California Berkeley, BERKELEY, CA*

2. The Effect of Using Residential Heat Pump for CO_2 Reduction (OR-25-C161)
Kijung Ryu[1], ***Kyu-Jung Kim, Ph.D., Full Member***[2], *Nenad Miljkovic, Member*[2], *Taeju Park*[1], *Hyoungsuk Woo*[1], *Eunjun Cho*[1], *Dongkeun Yang*[1] *and Simwon Chin*[1], *(1)LG Electronics, Seoul, Korea, Republic of (South), (2)University of Illinois Urbana-Champaign, Urbana-Champaign, IL*

3. Survey Among Hospital Organizations, Supported with Calculations and Measurements, Reveal a Great Potential of Operational Carbon Emission Reductions in Operating Rooms! (OR-25-C162)
Wim Maassen, MSc EngD, Full Member[1], *Jos Lans, MSc*[2], *Roberto Traversari, PhD*[3], *Gerbrand Middelkoop, BSc*[4] *and Sandra Lako, MD*[5], *(1)Royal HaskoningDHV, Rotterdam, Netherlands, (2)Delft University of Technology, Netherlands, (3)TNO, Netherlands, (4)Pro-OK-Advies, Netherlands, (5)Radboud University Medical Center, Netherlands*

4. Integral and Future Anticipating Approach to Design Buildings within the Paris Proof Operational and Embodied Carbon Budgets (OR-25-C163)
Wim Maassen, MSc EngD, Full Member *and Sven van Aspert, MSc, Royal HaskoningDHV, Rotterdam, Netherlands*

5. Environmental Benefits of Prefabrication in MEP Systems (OR-25-C164)
Bryan Cummings, Affiliate[1]*, Matt Roberts, PhD, Affiliate*[2]*,* ***John Williams***[3]*, Baz Cosmopoulos, Student, Student Member*[1]*, Cynthia Jocelyne Sandoval, Student*[1] *and Kathryn A Lee, P.E., Full Member*[3]*, (1)Harris Design Studio, Oakland, CA, (2)UC Berkeley, Berkeley, CA, (3)Harris, Oakland, CA*

11:00 AM - 12:30 PM

Paper Session 37

Controls

Track: Fundamentals and Applications
Room: Orange G
Chair: Michael Galler, Full Member, NIST Engineering Laboratory, Gaithersburg, MD
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1. Quantifying Energy Savings of Occupancy-Centric HVAC Controls Utilizing Longitudinal Occupancy Sensing Data and Calibrated Energy Simulations (OR-25-C165)
Leandro Pereira Pinheiro, Research Assistant, Student[1]*, Mingyue Guo, Student*[2]*, Zhihong Pang, Assistant Professor, Associate*[3] *and Zheng O'Neill, Ph.D., P.E., Fellow Member*[4]*, (1)LSU, (2)Texas A&M University, COLLEGE STATION, TX, (3)Louisiana State University , BATON ROUGE, LA, (4)Texas A&M University , College Station, TX*

2. A Decoupled Step-wise Model-based Optimal Control for Industrial Space Cooling: A Case Study of a Large-Scale Manufacturing Factory (OR-25-C166)
Dezhou Kong[1]*, Zhiang Zhang, Associate Member*[1]*, Xiaopeng Wang, National Registered Electrical Engineer*[2]*, Yihang Ye*[1]*, Dengfeng Du, Affiliate*[3] *and* ***Zesheng Yang***[3]*, (1)University of Nottingham Ningbo China, Ningbo, China, (2)University of Nottingham Ningbo China, NINGBO, China, (3)University of Nottingham.Ningbo.China, NINGBO, China*

3. Performance Assessment of a Model Predictive Controller for a Heat Pump in a Hardware-in-the-Loop Experimental Test Environment (OR-25-C167)
Caleb Jeremy Calfa, Student[1]*, Zhiyao Yang, Ph.D., Associate*[1]*, Zhelun Chen, Ph.D., Associate*[2]*, Yicheng Li, Student*[2]*, Yangyang Fu, Ph.D., Associate*[3]*, Zheng O'Neill, Ph.D., P.E., Fellow Member*[4] *and Jin Wen, Ph.D., Fellow S-B-a Member*[5]*, (1)Texas A&M University, COLLEGE STATION, TX, (2)Drexel University, Philadelphia, PA, (3)Texas A$M University, Philadelphia, PA, (4)Texas A&M University , College Station, TX, (5)Drexel University, PHILADELPHIA, PA*

4. Evaluating Thermostats' Deadbands Using HVAC Hardware-In-the-Loop Experiment for Advanced Control Strategies (OR-25-C168)
Sugirdhalakshmi (Sugi) Ramaraj, Researcher, Associate[1] *and Bethany Sparn, Full Member*[2]*, (1)National Renewable Energy Laboratory (NREL), (2)NREL, LAKEWOOD, CO, United States*

5. Implementation of a Reconfigurable Heat recovery Heat Pump and Control Plant Template and Its Use for Performance Evaluation (OR-25-C169)
Karthikeya Devaprasad, Associate[1]*, Junke Wang, Associate*[2]*, Lingzhe Wang, Associate*[3]*, Xing Lu, Associate*[4]*, Michael Wetter, Ph.D., Full Member*[5]*, Paul Ehrlich, P.E., Member*[6] *and Yan Chen, Ph.D., Full Member*[7]*, (1)Pacific Northwest National Lab, RICHLAND, WA, (2)Pacific Northwest National Laboratory, Richland, WA, (3)Pacific Northwest National Laboratory (PNNL), Richland, WA, (4)Pacific NorthWest National Laboratory, College Station, TX, (5)Lawrence Berkeley Lab, Berkeley, CA, (6)Building Intelligence Group, Afton, MN, (7)Pacific Northwest National Laboratory, Portland, OR*

11:00 AM - 12:30 PM

Seminar 58 (Intermediate)

LIVESTREAM: Climate-Adaptive Kitchen Ventilation Design Challenges Focusing on Hot and Humid Climates

Track: Ventilation and Indoor Environmental Quality

NY PDH G

Room: Orlando V
Sponsor: 5.10 Kitchen Ventilation
Chair: Francis J Kohout, Director of Engineering, Full Member, Cyclone Energy Group, CHICAGO, IL

Designing and ensuring proper operation of a kitchen ventilation system is already a challenging task. When the kitchen is in a hot and humid climate, this task includes additional challenges and considerations. This seminar presents design and operational criteria that should be considered when designing a kitchen in a hot and humid climate.

1. Designing and Operating a Kitchen Ventilation System for Hot and Humid Climates to Ensure Comfort, Energy Efficiency and Durability

Francis J Kohout, Director of Engineering, Full Member[1] *and Jason R Brown, Associate*[2]*, (1)Cyclone Energy Group, CHICAGO, IL, (2)Melink Corporation, MILFORD, OH*

2. Breathing Life into Your Kitchen: Techniques for Efficient Replacement Air

Gregory B Duchane, Full Member*, Trane, SAN JUAN, PR*

3. Understanding the Thermal and Humidity Dynamics of Ventless Hoods in Tropical Climates

Derek W Schrock, R&D Manager, Full Member*, Halton Company, NASHVILLE, TN*