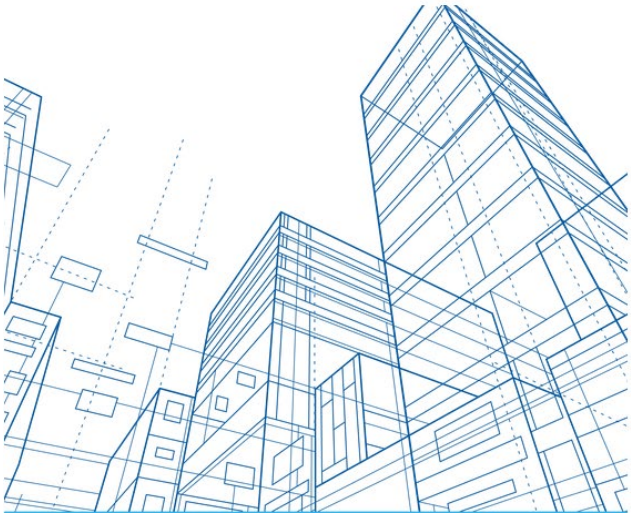

2024 ASHRAE Conference for Integrated Design, Construction & Operations

June 24-26, 2024

Indianapolis, IN

Monday, June 24

Monday, June 24, 8:00 AM - 9:00 AM

Keynote

Kent Peterson

Technology's Evolving Role in Advancing Decarbonization in Building Design, Construction and Operation

Monday, June 24, 9:45 AM - 10:45 AM

Panel 1

Beating the MacLeamy Curve

The MacLeamy curve illustrates the increasing costs of design modifications during the design process and is often used to advocate for smarter approaches to building design. Building information modeling tools and integrated process delivery strategies are two complementary approaches for navigating design complexities while achieving cost-effective designs. BIM and IPD rely heavily on architectural and engineering design software to enable design exploration, analysis, optimization, and collaboration. This panel brings industry experts together to explore recent advances in software tools and workflows which address the challenge of minimizing late-stage design changes while continuing to meet building cost and performance requirements.

9:45 AM - 10:45 AM

Seminar 1

AI-Integrated Energy Modelling Frameworks: Potentials, Challenges, and Future Directions

This seminar explores integrating artificial intelligence (AI) into building energy modeling. The approach automates energy modeling tasks, aligning with ASHRAE Appendix G guidelines. The methodology demonstrates AI's potential in early-phase energy modeling, allowing untrained users to perform advanced tasks through simple prompts. For professionals, it automates manual tasks, saving time and reducing errors. Challenges like data quality and interpretability are discussed with mitigation strategies. The presentation also envisions future directions for ASHRAE, emphasizing AI's role in enhancing energy modeling

for global efficiency and carbon reduction. The proposed workflow showcases AI's impact on energy efficiency analyses and simplifies complex modeling procedures.

AI-Integrated Energy Modelling Frameworks: Potentials, Challenges, and Future Directions

***Mo S Elsayed, PhD, Affiliate**, Page/EYP, Washington DC, DC*

11:00 AM - 12:00 PM

Seminar 3

Energy and Carbon Reduction Modelling & Analysis

This session explores energy and carbon reduction through several different analysis methods including using digital twin technology to model a chilled water plant to optimize energy, data analysis of case studies to understand embodied and operational carbon in multifamily house comparing retrofits, passive design and adaptive reuse, and a look at available data tools for designers wondering how the greening grid will play into their net zero calculations and projections.

1.Energy Optimization of a Chilled Water Plant through Intelligent Agents, Application Case: Design, Simulation and Implementation

***Jean Pierre Correa**, Universidad Nacional de Colombia, Floridablanca, Colombia*

The present study implemented a trained intelligent agent inside a digital twin of a chilled water plant to optimize its energy efficiency. This agent, in charge of defining the chilled water leaving temperature, was trained with real data from the operating points within the digital model, in order to explore the behavior of the variables under control, in this case the temperature of the conditioned area and the energy consumption of the plant. With these control variables, the reward function was defined on which the training of the agent was developed with data in approximately 25180 episodes, equivalent to 3 months in real time. For the purposes of the study, reinforcement learning DQN and SAC algorithms were implemented as agent training methods. As results of the analysis, optimization of up to 5% of the energy consumption of the chiller is obtained in partial load scenarios, 3.15% on average, optimization obtained with respect to the consumption of a chilled water plant equipped with a control system with load adjustment in the chiller through VFD in the compressor motor. The results obtained offer optimization opportunities in energy efficiency strategies and training of intelligent agents for the optimization of the operation of HVAC systems in their application spectrum.

2.Investments in Low-Carbon Living Focused on Operational and Embodied Carbon

***Jonghwa Na**, Gensler, New York, NY*

The United States is currently experiencing a significant shortage of housing, with projections indicating that roughly 20 million new residential units will be required in the coming decade. Given the urgent need to accelerate decarbonization, it is critical to address energy and carbon emissions in both new and existing multifamily buildings. However, older housing units are often inefficient, while new multifamily constructions in the U.S. are way behind in terms of codes and accomplishments. Despite the emphasis on reducing operational carbon emissions, embodied carbon emissions have largely been overlooked because of the challenges associated with quantifying them and their indirect impact on occupants. This study contends that both types of carbon emissions must be considered together to accurately measure total carbon emissions and presents Low-Carbon Living scenarios that compare the impacts of three alternatives: Deep Retrofit, Passive New, and Adaptive Reuse. Through a database of case studies with actual energy use data, this study identifies and prioritizes better investments based on their contribution to energy efficiency improvements. The Carbon Avoided Retrofit Estimator (CARE) Tool from Architecture 2030 is used to evaluate the three progressive scenarios based on the highlighted actions, while sensitivity analyses are conducted to assess the time frame required for evaluating total carbon trade-offs.

3.Cambium, Crrem, and Egrid, Oh, My!

***Alexandra Lowrie Love, Affiliate**, JLL, Charlotte, NC*

With the increasing pressure to reach net zero carbon by 2050, many designers are wondering how the greening grid will play into their projections. Fortunately, there are several data sources to choose from in the realm of predictive grid carbon intensity. From free data like Cambium, CRREM and eGRID, to paid options like WattTime, it can be hard to know where to start. Particularly since those options are poorly differentiated, and their methodologies are not clearly stated. This makes it difficult to feel confident in selecting one over the others. Especially when the results differ widely between data sets. There are several factors that designers might be interested in, such as the ability to model international scenarios, whether greenhouse gasses other than carbon dioxide are included, and what assumptions about future energy costs and regulations are, or are not, included. With so many projection models vying for our attention, it is imperative that designers parse out what data sets are most appropriate for which scenarios. In this presentation, key differences between and strengths of each data are discussed. Assumptions will be clearly summarized, and the implications of these inferences are presented.

2:15 PM - 3:15 PM

Seminar 5

Real Time Monitoring and Predictive Analysis

This session discusses CEVAC, Clemson University's Center for Energy Visualization and Analytics. The new technology and innovative predictive analysis that is driving significant successes in consumption reduction and fault detection is covered. This session also asks, "how much data is too much data"? "Are we asking the right questions"? The speaker focuses on data analytics starting with "what happened and why".

1.How Big Data and AI Optimize Campus Energy
***Snowil Lopes**, Clemson University, Clemson, SC*

The Clemson Energy Visualization and Analytics Center (CEVAC) is built upon four pillars—Operations, Education, Research, and Industry Collaboration. CEVAC leverages advanced analytics and modeling techniques on data sourced from thousands of sensors across the campus. This extensive data collection allows CEVAC to identify gaps and inefficiencies in energy consumption, paving the way for automated energy efficiency processes through the integration of big data management and machine learning.

2.Tackling Inefficiencies: The Power of Using Your Data
***Hannah Thomazin**, U.S. Engineering Company Construction, MO*

Many engineering and construction organizations are embarking on their digital transformation journeys. Unsure of which data to capture, many organizations capture it all; yet 96% of data is unused. What to do with all that data? The answer lies in seeking out progressive insights by asking: What happened? Why did it happen? What will happen next? And importantly, How can we make it happen? In this session, we discuss the power of data analytics starting with “what happened and why”, utilizing real-world examples from U.S. Engineering’s experience. The speaker also talks through the potential of predictive analytics use cases within the industry. By harnessing data, organizations can reduce costs, monitor performance, and streamline operations.

Monday, June 24, 3:30 PM - 5:00 PM

Panel 2

ASHRAE HQ Project: Lessons Learned

Moderator: Ginger Scoggins, Engineered Designs Inc, Cary, NC
Panelists: Stephanie Reiniche, ASHRAE, Peachtree Corners, GA, Stanton Stafford, PE, LEED Fellow, Member, Buro Happold, Atlanta, GA and Darren Draper, PE, LEED AP, Epsten Group, Atlanta, GA

ASHRAE renovated a 66,700 sq. ft. building, originally built in 1978 in metro Atlanta to be the Society’s new net-zero energy-efficient global headquarters. The building incorporated the Society’s energy and indoor air quality standards, while being cost effective, restorative, livable and resilient. Features like water efficient plumbing and landscape, energy efficient HVAC and lighting systems, as well as the ability to harness on-site energy production and be net-zero-energy-efficient were outlined as project goals. In this panel, former building committee chair and 2023-24 ASHRAE President Ginger Scoggins will moderate a discussion among project contributors as they examine lessons learned.

3:30 PM - 5:00 PM

Seminar 6

A Better Future Weather File for Energy Simulation

Predicting the future is a very difficult business indeed. Future weather files such as fTMY and XMY attempt to estimate future energy use via energy modeling, but through cooperative research with climatologists and energy modelers, five areas for improvement were identified, new future weather files were created, and the methodology published. The weather files were put to the test and used to evaluate a suite of buildings and the results of different conservation measures based on energy efficiency and resiliency will be discussed.

1.Future Weather Modeling Methodology Review
***Richard Graves**, Center for Sustainable Building Research, Minneapolis, MN*

This presentation will review the current alternatives to future and extreme weather files including fTMY and XMY among others. An analysis of file strengths and weaknesses will be evaluated.

2.Improved Future Weather Methodology for Energy Simulations
***Alexander B Harris, CEM - Certified Energy Manager, Associate**, HGA, Minneapolis, MN, United States*

Collaborative, Minnesota state-funded work with climatologists and energy modelers to address the issues with current future weather files including research and methodology will be presented with practical applications such as Sustainable Buildings 2030 Energy Standard and potential synergies with ASHRAE standard 189.1.

3.Modeling Savings and Resiliency with Future Weather Files
Christopher B Baker, AIA, Full Member*, Willdan, Anaheim, CA*
The future weather file research reaches practical applications with improved energy modeling results for practioners. This presentation will compare, contrast, and summarize energy model results over a range of building types analyzing various conservation measures for savings and resiliency.

Tuesday, June 25

Tuesday, June 25, 8:00 AM - 9:00 AM
Keynote

Rajnish B. Setty

Data Driven Future for Integrated Design, Construction and Operations

This talk presents a vision for a Data-Driven Future in Design, Construction, and Operations. Digital twins, serving as digital replicas of buildings, combined with AI, promise predictive optimization across a building's lifecycle. This innovative approach enables anticipatory adjustments to improve energy efficiency and occupant comfort, marking a shift to proactive building management. Essential to realizing this vision are advancements in digital twins for predictive analytics, dynamic ontologies for knowledge integration, and AI algorithms for learning from data. Despite challenges, this paradigm offers unparalleled opportunities for sustainability, operational efficiency, and occupant satisfaction, steering the built environment towards autonomy and intelligence.

9:45 AM - 10:45 AM
Seminar 7

Digital Twin 101
This session explores real life case studies about setting up and using Digital Twin technology to improve the predictive analysis and performance of operating the built environment.

1.From Deployment to Utility: Harnessing Your Digital Twin
David Solano*, Georgia Institute of Technology, Atlanta, GA*
The utilization of a post-construction real-time digital twin can enhance building control methodologies through the integration of the Building Energy Model (BEM) and the Building Automation System (BAS). This seminar aims to provide an overview of both the data management system supporting this framework as well as case studies of digital twin use cases. The presentation also explores the utilization of digital twins to orchestrate advanced control strategies through a case study. While traditional building control is set around maintaining certain setpoints or schedules, BEM-BAS based control can opt for a more holistic control approach by incorporating external/internal factors such as weather forecasts, grid signals and occupancy patterns\forecasts.

2.A Digital Twin Case Study: How to Structure Your Data to Get Started
Rajnish B Setty, Full Member*, Setty, Atlanta, GA*

3.A Digital Twin Approach for District Energy Systems
Jung-Ho Lewe, Ph.D., EMP, Full Member*, Georgia Institute of Technology, Atlanta, GA*
This case study represents the development, implementation, and utility of a digital twin for the district energy system at Georgia Institute of Technology. The process conglomerates and synchronizes various technologies and methodologies, including a Geographic Information System (GIS) mapping of the chilled water infrastructure, swiftly adapted and imported into a physics-based model of the district energy system. The model comprehensively represents the campus chilled water network, with each

building characterized by its own class containing essential components and parameters such as return temperature and cooling power requirements.

Tuesday, June 25, 11:00 AM - 12:00 PM

Debate 1

ASHRAE Corner Debate

The tools utilized for design, communication, and documentation in the construction industry have evolved significantly from the days of hand drafting, blueprints, and slide rules. While there are many different tools with varying capabilities available to construction professionals, are they what is needed in the industry today?

11:00 AM - 12:00 PM

Panel 4

President's Roundtable on Workforce Development

Moderator: Dennis Knight, P.E., Fellow ASHRAE, Whole Building Systems, LLC, Mt. Pleasant, SC
Panelists: Darryl Boyce, Carleton University, Kemptville, Canada, Luke C H Leung, PE, Fellow Member, Skidmore Owings & Merrill, CHICAGO, IL, Luke Moylan, Pipefitters Local Union No. 533 and Martin Dieryckx, Fellow Member, Daikin Europe N.V., Torhout, Belgium

Join newly appointed ASHRAE president Dennis Knight and a panel of industry executives as they discuss the very real problem of Workforce Development for HVAC&R. Meeting the challenge of building and renovating high performance buildings that are carbon neutral and energy efficient will require skilled engineers, designers, contractors and facility managers. How will HVAC&R compete with other tech savvy industries to attract new workers and engage and upskill the existing workforce to face the world's most significant challenge – climate change?

Tuesday, June 25, 1:30 PM - 3:00 PM

CIDCO Showdown

CIDCO Showdown

This year's Proposed Model Building is a mixed use, multilevel medium-sized office building located at 8710 Hague Road, Indianapolis, Indiana, 46256 (the conference city!). Teams will complete to design all major building systems including the building enclosure, HVAC, refrigeration, lighting, water heating, plug loads, and any on-site renewable or other energy systems.

1:30 PM - 3:00 PM

Seminar 8

Resilience and Modelling Future Weather

1.Temperature Projections: How Climate Change Impacts on Current and Future Extreme Heat Can Affect Heating and Cooling System Design

***Jaclyn R Kinson, Associate**, CDM Smith, Boston, MA*

Increases in greenhouse gas (GHG) emissions cause increases in the earth's temperature. These impacts have already been felt, and the future projections are cause for concern in many areas of the US. Understanding these projections are key to creating resilient designs of heating and cooling systems. The Global Climate Model (GCM) creates relatively accurate Annual Average Temperature projections. The recent trends in annual temperature align with the GCM projections. Temperatures have been increasing for over a century and the data shows that these increases have accelerated over the past 30 years.
Increased average annual temperatures and humidity levels translate to increases in extreme heat events. The number of days above a variety of temperature thresholds can be calculated, but this does not tell the entire story as humidity levels have also been increasing. Temperature and humidity combine to form the well-known Heat Index used by NOAA as well as wet bulb temperatures important for air conditioning design. This presentation explains weather projections for both extreme cold and extreme heat, showing how to use GCM output and additional tools to plan for changes to summer and winter temperatures.

2.Creating Climate Resilient Communities (CRC) By a Multi-Scale Designing Framework

***Lili Ji**, National Research Council, Ottawa, ON, Canada*

This presentation introduces a pioneering project centered on creating Climate Resilient Communities (CRCs) through a multi-scale designing framework. The escalating impacts of climate change, such as heatwaves, wildfires, floods, and droughts, underscore the global threat faced by communities. Specifically, summertime heatwaves affect urban areas on a multi-scale basis, including interactions with urban heat islands (UHIs) and community-scale microclimate, which escalate pedestrian-level thermal

stress, building overheating risks and energy consumption. CRCs possess the capacity to tolerate and swiftly recover from the disturbances of heatwaves, maintain pedestrian/indoor thermal comfort and mitigate building cooling loads. The spatial distribution of urban local climate zones (LCZs) significantly influences CRCs, necessitating a design approach that integrates both urban-scale climate and community-scale microclimate considerations. In CRCs, the optimized configurations of buildings and greenery, balancing cost-effectiveness, maximize cooling and aerodynamic effect in regulating urban microclimate and overcoming community vulnerability. However, the absence of guidelines for optimizing CRC design amid rapid climate change poses a challenge. To address this gap, a multi-scale CRC design framework, focusing on urban block and landscape design, is urgently needed. The objective of this project is to develop design guidelines for CRCs confronting the challenges posed by both present and future climate scenarios.

3.Retrofits to Improve Resilience of Residential Buildings to Overheating Stress and Wildfire Smoke Exposures
***Chang Shu, Rea**, National Research Council Canada, Ottawa, ON, Canada*
In the face of escalating climate challenges, the project "Retrofits to Improve Resilience of Residential Buildings to Overheating Stress and Wildfire Smoke Exposures" addresses the critical need for making residential buildings safer and more comfortable. This comprehensive study encompasses a series of tasks, ranging from the initial preparation, sensor deployment, and data analysis to the implementation and assessment of various intervention strategies. The project's methodology includes a detailed literature review, deployment of advanced sensors, and collaborations with industrial partners for retrofitting solutions. Key objectives include improving indoor environmental quality (IEQ) and occupant health, reducing energy consumption, and offering actionable insights for future building standards and retrofit guidelines. The project, spanning multiple provinces in Canada including Ontario and Quebec, aims to create a scalable model for enhancing the resilience of residential buildings in diverse climates and conditions.

4.5 Resilience Simulations to Make Better Buildings
***Alexandra Lowrie Love, Affiliate**, JLL, Charlotte, NC*
As the extreme and unpredictable effects of climate change continue to impact a growing number of people, we are forced to face the fact that net zero carbon emissions in building design might not be enough to ensure the safety and reliability of occupiable structures in the future. There is an increased need for buildings to function well, not just in the best-case scenario, but also in droughts, power outages, and extreme weather events. This idea of functioning well in adverse circumstances is called resilience. When buildings are not resilient, hospital workers break windows in the aftermath of a hurricane so patients can breathe fresh air at a safe temperature. Without resilience, there is a plague of frozen pipes after a polar vortex blows into Texas. Without resilience, public sanitation, cooling for nuclear reactors, and food production compete for water in ever more intense drought conditions. While we have many codes and standards to define how to properly model a net zero carbon design, like ASHRAE 228, defined parameters are lacking for simulating resilience. Few people can even agree what resilience is, much less how to quantify, methods to simulate, and parameters to determine success when analyzing it. This presentation clarifies what resilience is in the context of the built environment and uses scientific information to determine what resilient performance looks like.

Tuesday, June 25, 3:15 PM - 4:45 PM

Panel 5

ASHRAE Fishbowl

Moderator: Mitchell Swann, P.E., Life Member, Resolution Management Consultants, Philadelphia, PA
A fishbowl panel discussion comes from a popular open fishbowl conversation format. Members of the audience sit on stage or in the center of the room to discuss a topic introduced by the panel moderator. At any time, any member of the audience can join the fishbowl panel by replacing an existing participant. The discussion continues with participants frequently entering and leaving the panel until the time is up. The moderator then summarizes the discussion.

3:15 PM - 4:45 PM

Seminar 9

Energy Master Planning of a Geothermal Community

Sponsor: 7.3 Operation, Maintenance and Cost Management, 7.6 Building Energy Performance, 6.8
Chair: Jill Kurtz, Page Southerland Page, Inc., Weston Lakes, TX
Yampa Valley Housing Authority’s master plan for workforce housing needed a complementary energy framework to inform the community horizontal and vertical energy infrastructure. The team developed a strategy to compare multiple systems including community geothermal and analyzing lifecycle costs, carbon, net zero potential, peak modeling, and community impact benefits. The team worked closely with the Yampa Valley Sustainability Council’s, coordinated load calculations with Yampa Valley

Electric Cooperative, and connected analysis to potential grants and funding streams. Presenters will discuss the complexity of community scale modeling, stakeholder engagement, early feasibility for geothermal master planning, and a triple bottom line analysis.

1.Calculating for the Plan: Modeling to Reveal the Right Approach
***James Principe, Associate**, Page, Weston Lakes, TX*

2.Coordinating the Plan: The Influence of Partners
***Greg Tinkler, CGD, Full Member**, Page/, Fulshear, TX*

3.Community Engagement for the Plan: Stakeholder Education and Board Adoption
***Catherine A Tinkler, EBCP, PMP, LEED AP O+M, Associate**, Page Southerland Page, Inc., Weston Lakes, TX*

Wednesday, June 26

Wednesday, June 26, 9:45 AM - 10:45 AM

Panel 6

The Importance of Optimizing Distributed Energy Resources in Grid Interactive Buildings for Carbon Neutrality

Moderator: Snowil Lopes[1]
Panelists: Ramtin Hadidi[1], Miles Hunter Martschink Jr, P.E., Associate[2] and Wayne Johnson[3], (1) Clemson University, Clemson, SC, (2) RMF Engineering, Clemson, SC, (3)Duke Energy

For commercial and institutional buildings, decarbonization efforts like solar have slowed due to larger demand, rooftop complexities and cost benefit considerations. Yet, commercial and institutional buildings would benefit from newer technologies in distributed energy resources such as small hydro/wind turbines, solar PV, batteries, and on-premises recovery systems. These systems enable larger buildings to distribute energy resources which can use and create energy behind the utility meter, store it for demand flexibility and feed energy into the grid when net positive. DER's can be connected for generation and distribution both locally and externally.

9:45 AM - 10:45 AM

Seminar 10

BIM Standards and Guidelines for Integrated Building Design and Construction

Currently, there are many Building Information Modeling (BIM) standards and guidelines available in the marketplace. This seminar focuses on explaining 2 specific BIM standards including ASHRAE SPC-224 (an ANSI standard) and National Institute of Building Sciences' NBIMS 4.0. In addition, it focuses on how these standards are used in practice by owners, engineers, and architects. Speakers discuss the similarities and differences between them and how they could work together to provide a comprehensive set of BIM standards.

1.How Building Owners, Architects, and Engineers Can Use These Standards in the BIM Workflows
***Kimberly Pierson**, Moseley Architects, Raleigh, NC*

Kim Pierson discusses how these two standards could be used by owners, architects, and engineers. For building owners, BIM standards offer improved decision-making capabilities by providing comprehensive digital representations of their assets, enabling better management of operations and maintenance. Architects benefit from standardized protocols that ensure consistency in design documentation, fostering clearer communication and streamlined workflows. Engineers leverage BIM standards to optimize system integration, enabling accurate analysis and simulation of building performance, leading to more sustainable and cost-effective solutions.

2.Overview of the Next Generation BIM Standard at NIBS – National BIM Standard 4.0
***Carrie Dossick**, University of Washington, Seattle, WA*

The National Institute of Building Sciences' (NIBS) BIM Council is updating the National BIM Standard Version 3 to Version 4. To update the standard, the Council formed 5 workgroups focused on drafting content for this next version. The focus is on standards that can be referenced in agreements and guidance to support adoption. The session will identify key content of the NBIMS, publication status, coordination with other related standards and new areas of focus for additional modules under development.

3.Overview of ASHRAE SPC-224: Standard for the Application of Building Information Modeling
***Stephen B Roth, PE, Full Member**, Carmel Software Corp, SAN RAFAEL, CA*
ASHRAE SPC-224, titled "Standard for the Application of Building Information Modeling" is a draft ANSI-standard whose purpose is to provide minimum requirements for the application of Building Information Modeling (BIM) to the planning, design, construction and operation of buildings. It defines how to incorporate BIM requirements in design, construction and operations services contracts and is geared toward building owners. Stephen will discuss the origins of SPC-224, the process by which the SPC-224 committee converted an existing guideline into mandatory language, and why this ANSI standard is a welcome addition to the universe of BIM standards and guidelines.

Wednesday, June 26, 11:00 AM - 12:00 PM

Seminar 11

Looking to the Future: Weather Data Opportunities and Challenges

This session provides a comprehensive view of considerations, including opportunities and challenges, for the use of future weather data in design and analysis. This session showcases three different perspectives and highlights that not all future weather data is the same, and the many applications. Following the presentations, there will be time for discussion to align or find gaps, and questions including a call to action.

1.Machine Learning for the Creation of Future Weather Files in Building Physics Simulations
***Barbara Gao**, Thornton Tomasetti, New York, NY*
Weather files are crucial in building physics analysis but with climate change, the use of historic data may not adequately represent the range of conditions faced throughout a design's service life. This study focuses on the creation of future weather data using Artificial Intelligence (AI), exploring a pathway compliment to physics-based models with the time and computing power savings. AI models analyze past weather data to learn cause-and effect relationships between weather conditions. This learning allows model to find subtle trends and patterns inside the data which it extrapolates to predict what could be coming.

11:00 AM - 12:00 PM

Seminar 12

Solving Complex Design Challenges Using Computational Models and BIM Collaboration

This session focuses on approaches to solving complex design challenges with respect to safety and comfort. Using computational models, design teams are improving fire protection safety for first responders. Occupants are improving occupant comfort experiences in musical performance centers. Using a common data environment to collaborate on the expansion of a mass transit system serving millions of riders daily is also examined.

1.Moving Toward Smart Fire Protection: Develop a Protocol for Fire Protection Decision-Making Based on Building Information Model & Fire Dynamic Model
***Xiaolei Chen, PhD**[1] and **Frank Wang, Senior Fire Protection Engineer**[2], (1) California State University, Los Angeles, LOS ANGELES, CA, (2) Jensen Hughes, Los Angeles, CA*
Smart fire protection, according to fact sheet of National Fire Protection Association, "produces data that can help the fire service assess risks before, during, and after incidents". Upgrading the fire protection process and system to a smarter version will make the fire protection service more efficient and effective. The ability to retrieve real-time information is a critical factor in making informed decisions for fire protection. This project comes up with a new approach that can efficiently handle the fire and building data through a real-time 3D building and fire/smoke dynamic model. It proposes a smart fire protection protocol by combining the two computational models, BIM (Building Information Modeling) and FDS (Fire Dynamic Simulator). The model will integrate the data collected via existing fire/smoke detection devices in the building and generate a three-dimensional fire and smoke spread model for the entire structure that can provide accurate information to support the decision-making by the fire rescue team as well as provide evacuation guidance for occupants in the building. For example, informing them to stay in shelter, choose a safe exit path, move toward the nearest safe exits/pathways, etc.

2.Computational Fluid Dynamics for Thermal Comfort Analysis - Brown University Case Study
***Christopher Ethan Nazareno, Mechanical Engineer, Associate**, Arup, New York, NY*
Thermal comfort is a key aspect of building design and operation. ASHRAE Standard 55 establishes the criteria for thermal environmental conditions in various occupied spaces. From the standard, thermal comfort is defined as the condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation. It is dependent on factors such as air temperature, air velocity, clothing insulation and relative humidity.
At the Lindemann Performing Arts Center at Brown University, the design team carried out a study to predict thermal comfort during a summertime orchestra concert within the building's main hall. Through collaborative efforts between the various consultants involved in the project, the team established all the design conditions to be included in the study. These conditions

included the geometry of the space, the number of patrons, the sets of heat-generating audio/visual and theatrical equipment, and the characteristics of supply air at floor outlets throughout the space. The results indicated that the majority of the patrons would be within the acceptable PMV and PPD ranges for thermal comfort and aided the team in finalizing the design strategy for the main hall.

3.Delhi Metro's Digital Transformation with BIM Solutions

Sekh Samim, Deputy Chief Architect, Affiliate*, Delhi Metro Rail Corp, New Delhi, India*

This presentation focuses on the transformative Phase IV project of the Delhi Metro, a critical expansion to new housing areas in the National Capital Region. Covering six additional routes and connecting prominent locations in West Delhi and Faridabad, the project aims for completion by December 2024, with an estimated cost of Rs 45,000 crore and an expected daily ridership of 1.5 million passengers. The session delves into the project's innovative execution, leveraging Autodesk technology to streamline workflows and enhance decision-making. The integration of Building Information Modelling (BIM), cloud collaboration, and a Common Data Environment (CDE) reflects a commitment to digital transformation. Autodesk's BIM 360 and Navisworks play pivotal roles in fostering collaboration and providing real-time data exchange among project stakeholders.

The presentation also highlights the disruptive impact of the project, emphasizing enhanced collaboration, improved design and construction processes, and efficient project management. Mandating BIM and cloud collaboration tools facilitates seamless collaboration, design visualization, and early issue identification. The adoption of a CDE ensures unified access to project information, minimizing data duplication, and improving overall project efficiency.

The measurable outcomes of sustainability design principles through BIM are explored.