

## Table of Contents

<b>Modeling the Load Flexibility Potentials for Ice Energy Storage</b>	1
<i>Karl, Heine; Paulo Cesar, Tabares-Velasco; Ryan, Meyer; Michael, Deru</i>	
<b>Data-Driven Predictive Control for Commercial Buildings with Multiple Energy Flexibility Sources</b>	9
<i>Anjukan, Kathirgamanathan; Mattia, De Rosa; Eleni, Mangina; Donal P., Finn</i>	
<b>Evaluating Facility Energy Efficiency and Resilience Opportunities with FEDS and MCOR</b>	19
<i>Robert, Dahowski; Sarah, Newman; Varun, Sood; Travis, Douville</i>	
<b>Characterization of Connected Lighting System Potential for Grid Services Under Real-Time Pricing</b>	27
<i>Peng, Wang Michael R., Brambley Michael E., Poplawski Michael, Myer</i>	
<i>Jianming, Lian Robert G., Lutes Sen, Huang Alex, Vlachokostas</i>	
<b>A Framework for Delivering Energy Efficiency and Decentralised Energy Generation Projects to Tackle Fuel Poverty and CO<sub>2</sub> Emissions in Cities</b>	35
<i>Javier, Urquiza; Carlos, Calderón; Philip, James</i>	
<b>Buildings-to-Distribution Network Integration to Enable Voltage Regulation Considering Renewable Energy Resources</b>	44
<i>Hannah, Fontenot Krishna Sandeep, Ayyagari Bing, Dong Nikolaos, Gatsis</i>	
<i>Ahmad, Taha</i>	
<b>Optimal Efficiency and Operational Cost Savings: A Framework for Automated Rooftop PV Placement</b>	53
<i>Rawad, El Kontar; Xin, Jin</i>	
<b>Towards a Standardized Framework for Thermal Resilience Modeling and Analysis</b>	61
<i>Ted, Kesik; William, O'Brien; Aylin, Ozkan</i>	
<b>Machine Learning Based Optimization Approach for Building Energy Performance</b>	69
<i>Aslihan, Senel Solmaz</i>	
<b>Using Simplified Geometry Model to Improve Energy Modeling Efficiency and Reduce Cost</b>	77
<i>Yiyuan, Jia; Fred, Betz</i>	
<b>A Common Language to Design Carbon Neutral Projects by 2030</b>	87
<i>Tommy, Zakrzewski; Mike, Brown; Kyleen, Rockwell</i>	
<b>Daylight Availability and Occupant Visual Comfort in Seattle Multi-Family Housing</b>	93
<i>Guanzhou, Ji</i>	
<b>Challenging Conventional Approaches for Climate-Based Daylight Simulations of Multi-Unit Residential Buildings</b>	103
<i>Terri, Peters; Noor, Alkhaili; Ted, Kesik; William, O'Brien</i>	
<b>The Solar Heliodon: Physical Simulation of Dynamic Daylighting Conditions in Scale Architectural Models for Subjective and Objective Human-Factors Evaluation</b>	111
<i>Kyle, Konis</i>	
<b>A Framework to Simulate the Non-Visual Effects of Daylight on the Cognitive Health of Mild Cognitive Impairment (MCI) People</b>	119
<i>Nourhan, Elsayed; Tarek, Rakha</i>	
<b>Spatial Daylight Autonomy Imprecision Correlated to the Increased Application of Daylight Driven Design</b>	130
<i>Kyleen, Rockwell</i>	

<b>Modeling and Cost-Effectiveness Analysis of Zero Net Energy Homes in California</b>	136
<i>Sang Hoon, Lee; Max, Wei; Tianzhen, Hong</i>	
<b>Assessing Resiliency and Passive Survivability in Multifamily Buildings</b>	144
<i>Lisa M., White; Graham S., Wright</i>	
<b>A Generic Energy Flexibility Evaluation Framework to Characterise the Demand Response Potential of Residential Buildings</b>	156
<i>Adamantios, Bampoulas Mohammad, Saffari Fabiano, Pallonetto Eleni, Mangina Donal P., Finn</i>	
<b>Optimal Operation for Resilient Communities through a Hierarchical Load Scheduling Framework</b>	165
<i>Jing, Wang; Kaitlyn, Garifi; Kyri, Baker; Wangda, Zuo; Yingchen, Zhang</i>	
<b>Evaluation of an Evolving Housing Stock: Scenarios Towards Its Decarbonisation</b>	173
<i>Gustavo, Sousa</i>	
<b>A Building Envelope Characterization Workflow for In-Situ Thermal Performance Assessment</b>	180
<i>Tyler, Pilet; Tarek, Rakha</i>	
<b>Diverse Occupancy Simulation and Presence Sensing Viability for Residential Thermal Energy Regulation: Review and Initial Findings</b>	190
<i>Tarek, Sherif; Tarek, Rakha</i>	
<b>Review of Non-Destructive Techniques (NDTs) for Building Diagnostic Inspections</b>	201
<i>Yasser, El Masri; Tarek, Rakha</i>	
<b>Numerical Investigation of External Convective Heat Transfer Coefficient for Buildings in Different Land-Use Class</b>	214
<i>Anwar D., Awol; Girma T., Bitsuamlak; Fitsum A., Tariku</i>	
<b>Impact Analysis of Personalized Thermostat Demand Response</b>	222
<i>Kunind, Sharma; Michael, Kane</i>	
<b>A Novel Approach to Modelling Air Flow Through Operable Windows in High-Rise Multi-Unit Residential Buildings Using Energy Plus</b>	230
<i>Jamie P., Fine; Marianne F., Touchie</i>	
<b>Efficient Computation of Surface Sunlit Fractions in Urban-Scale Building Modeling Using Ray-Tracing Techniques</b>	238
<i>Xuan, Luo; Yu-Hang, Tang; Tianzhen, Hong</i>	
<b>A New Calculating Method of the Effect of Natural Ventilation Control in Office Buildings with Buoyancy Driven Ventilation</b>	244
<i>Kei, Shimonosonol; Kimiko, Kohri; Hisaya, Ishino</i>	
<b>ARINet: Using 3D Convolutional Neural Networks to Estimate Annual Radiation Intensities on Building Facades</b>	252
<i>Jung Min, Han; Chih-Kang, Chang; Ali, Malkawi</i>	
<b>Verification of ANN Solar Radiation Prediction Algorithm for Real-Time Energy Simulation</b>	260
<i>Hany, Gaballa; Soolyeon, Cho</i>	
<b>Design and Development of a Decentralized and Distributed IoT Home Monitoring System Within a DC Nanogrid</b>	267
<i>Jonathan, Ore; Eckhard A., Groll</i>	

<b>High-Level Model Articulation with Buildingsync and OpenStudio</b>	
<i>Cory, Mosiman Nicholas Lee, Long Tobias, Maile Katherine, Fleming Christopher, CaraDonna</i>	275
<b>Towards a Standard Climate Data Model for Building Design and Analysis</b>	
<i>Sagar, Rao; Parag, Rastogi</i>	285
<b>URBANopt: An Open-Source Software Development Kit for Community and Urban District Energy Modeling</b>	
<i>Rawad, El Kontar Ben, Polly Tanushree, Charan Katherine, Fleming Nathan, Moore Nicholas, Long David, Goldwasser</i>	293
<b>Live BIM for Capturing Dynamism of Physical Spaces, Occupants and Assets Through Linked Data</b>	
<i>Arash Hosseini, Gourabpasi; Mazdak, Nik-Bakht</i>	302
<b>Energy and Ventilation Performance Analysis for CO2-Based Demand-Controlled Ventilation in Multiple Zone VAV Systems with Multiple Recirculation Paths</b>	
<i>Xing, Lu; Tao, Yang; Zheng, O'Neill; XiaoHui, Zhou</i>	308
<b>A New Detailed Model of Wood Pellet Boilers</b>	
<i>Timothy, McDowell; Khaled, Yousef; John, Siegenthaler; Thomas, Butcher</i>	317
<b>Deriving Simulation Parameters for Storage-Type Water Heaters Using Ratings Data Produced from the Uniform Energy Factor Test Procedure</b>	
<i>Jeff, Maguire; David, Roberts</i>	325
<b>Effect of Geometry and Operational Parameters Over the Dehumidification Performance of a Desiccant Coated Heat Exchanger</b>	
<i>Ming, Qu; Thomas Pablo, Venegas; Kashif, Nawaz; Lingshi, Wang</i>	332
<b>Seasonal Performance Simulation of a Gas-Fired Chemisorption Heat Pump for Residential Heating in Cold Climate</b>	
<i>Zhiyao, Yang; Ming, Qu; Kyle R., Gluesenkamp</i>	342
<b>A Rewarded-Project Story from Japan: Comfort vs View in a Fancy Glazed Atrium</b>	
<i>Yasin Mohamed Ibrahim, Idris Nakagawa, Hiroaki Hajime, Iseda Nagata, Takuya Xu, Tianshu Kuniaki, Ando Kunihiko, Fujiwara</i>	349
<b>The Case for Multicriteria Annual Sunlight Exposure Guidelines</b>	
<i>Belal, Abboushi</i>	358
<b>Development of a Fast Prediction and Interactive Design Method of Visual Comfort for Indoor Multisport Facilities Based on AcceleradRT Real-Time Simulation Feedback</b>	
<i>Lingling, Li; Yu, Li</i>	374
<b>Modeling and Simulation of a Campus Living Building: A Case Study in Uncertainty Analysis and Stress Testing</b>	
<i>Tanushree, Charan; Sol, Haroon; Godfried, Augenbroe</i>	384
<b>Improving Model Calibration Methods: A Case Study Application of Incorporating IEQ with Energy</b>	
<i>Nishesh, Jain; Esfand, Burman; Dejan, Mumovic; Michael, Davies</i>	392
<b>Empirical Validation of Multi-Zone Building and HVAC System Models Under Uncertainty</b>	
<i>Qi, Li; Ralph T., Muehleisen; Piljae, Im; Jaewan, Joe</i>	408
<b>Ranking Energy Influential Parameters - How Building Type Affects the Parameters' Influence</b>	
<i>Rafaela Orenga, Panizza; Mazdak, Nik-Bakht</i>	416

<b>Simple Building Calculator</b>	423
<i>Chitra, Nambiar; Reid, Hart</i>	
<b>Calculating Fenestration System U-Factor, SHGC, and VT Using Partially Automated Workflows</b>	431
<i>Sarah, Rentfro</i>	
<b>Shaping High-Rise Towers to Meet BC Energy Step Code</b>	439
<i>Haobo, Liu; Andrea, Frisque; Jeanie, Chan; Bowen, Xue; Oscar, Valdes</i>	
<b>Research on Guidelines for Window Design Strategies in High Performance Office Buildings</b>	447
<i>Qinbo, Li; Jeff, Haberl</i>	
<b>A Modeling Framework for Engine-Neutral Automation of Building Analysis and Compliance Reporting</b>	455
<i>Eric, Niemeyer; Sagar, Rao</i>	
<b>Energy Analysis of Steam Distribution System Using a Physics-Based Model: A Campus Building Case Study</b>	463
<i>Behzad Saliman, Rizi Akram Syed, Ali Christopher, Riley Brent, Stephens Mohammad, Heidarinejad</i>	
<b>Future Meteorological Year Weather Data from IPCC Scenarios</b>	471
<i>Brett, Bass; Joshua, New</i>	
<b>Impact of Soil Temperature Variation on Performance Modeling of a Novel Shallow Bore Ground Heat Exchanger</b>	478
<i>Liang, Shi; Ming, Qu; Xiaobing, Liu; Mingkan, Zhang</i>	
<b>Effective Strategies for Reducing Plug Load: Results from a Field Study Conducted at Two of the Largest US Banks</b>	487
<i>Andrea, Lieberman; Robert W., Cox; Benjamin, Futrell</i>	
<b>Study of the Whole Building Energy Use Inverse Modeling Performance through Support Vector Machine Regression</b>	494
<i>Shinwoo, Lee; Juan Carlos, Baltazar</i>	
<b>Water Treatment Technologies in Whole Building Energy and Water Models</b>	502
<i>Fred, Betz; Sarah, Balz</i>	
<b>Masterplanner: A Central Utility Plant Design and Optimization Tool</b>	510
<i>Te, Qi; Pouya Rezazadeh, Kalehbasti</i>	
<b>Lifting the Garage Door on Spawn, an Open-Source BEM-Controls Engine</b>	518
<i>Michael, Wetter Kyle, Benne Antoine, Gautier Thierry S., Nouidui Agnes, Ramle Amit; Roth Hubertus, Tummescheit Stuart, Mentzer Christian, Winther</i>	
<b>Development of Baseline Building Energy Models for the Advanced Occupant-Centric Building Control Research in the Various U.S. Climates</b>	526
<i>Zhihong, Pang; Yan, Chen; Jian, Zhang; Zheng, O'Neill; Yulong, Xie</i>	
<b>Application of Deep Learning in Generating Desired Design Options: Experiments Using Synthetic Training Dataset</b>	535
<i>Zohreh, Shaghaghian; Wei, Yan</i>	
<b>Decentralized Approach to Multi-Zone Grey-Box Modeling for Model-Based Predictive Control</b>	545
<i>Jaewan, Joe; Borui, Cui; Piljae, Im; Jin, Dong; Kuruganti, Teja</i>	

Demand Response Assessment Tool: A Cloud-Based Simulation Tool for Rapid Assessment of Demand Response Potential in Commercial and Institutional Facilities <i>Benjamin, Futrell; Madison, Wynn; Eric, Tate; Robert W., Cox</i>	552
Comparing the Performance of Optimization Methods Used for Building Design and Optimal Control of Building Systems <i>Afshin, Faramarzi; Parastoo, Delgoshaei; Brent, Stephens; Mohammad, Heidarinejad</i>	560
Occupants' Comfort at Urban Scale: Analyzing Citizens' Opining Using Convolutional Neural Networks <i>Farzaneh, Zarei; Mazdak, Nik-Bakht</i>	567
Investigation of the Potential Benefits of Optimizing Building Element Placement Using Computational Fluid Dynamics <i>Nastaran, Shahmansouri Rhys, Goldstein Farhad, Javid Alex, Tessier Simon, Breslav Azam, Khan</i>	574
BIM-CFD Integrated Sustainable and Resilient Building Design for Northern Architecture <i>Muna, Younis; Meseret T., Kahsay; Girma T., Bitsuamlak</i>	584
Large Scale Modelling of Wind Comfort and Safety Using 'Pedestrian Comfort Analysis' - A Cloud-Based App for Architects <i>Sandip, Jadhav; Vijay, Mali; Praveen Kumar, Ramachandran; Chaitanya, Rane</i>	592
Outdoor Thermal Comfort (OTC) in Human Interaction-Based Studies: An Overview of Reviews <i>Zahida, Khan; Rahman, Azari; Brent, Stephens</i>	600
Integrating Layout Geometry with Architectural Requirements to Achieve Energy-Efficient Office Buildings in Egypt <i>Hebah, Moanis Hatem; Mai, Alaaeldin Karram</i>	610
Evaluation of Rammed Earth Assemblies as Thermal Mass Through Whole-Building Simulation <i>Pragya, Gupta; Dana, Cupkova; Lola, Ben-Alon; Erica, Cochran Hameen</i>	618
Education of Passive Systems in the US Architecture Schools: from the Conceptual Level to the Levels of Simulation and Calculation <i>Mehdi, Azizkhani</i>	626
Parametric Sensitivity Study in Design of Double Skin Facades for Large Space Buildings in Cold Regions of China <i>Siyu, Cheng; Gang, Liu</i>	634
Using Parametric Simulation GIS to Design a Stormwater Solution for a Chinese Sponge City <i>Christopher, Drew; Patrick, Keeney; Xi, Yi</i>	642
Data-Driven Local Area Energy Framework for Modeling Domestic Heat Electrification <i>Joey, Aoun; Carlos, Calderón</i>	651
Large Scale Post-Simulation Data Processing and Visualization for Building Energy Analysis <i>Junru, Shen; Jeanie, Chan; Andrea, Frisque</i>	660
Extract Useful Information from Building Permits Data to Profile a City's Building Retrofit History <i>Wanni, Zhang; Tianzhen, Hong; Xuan, Luo</i>	667

**Urban-Scale Energy Modeling: Scaling Beyond Tax Assessor Data**  
*Joshua, New; Mark, Adams; Eric, Garrison; Brett, Bass; Tianjing, Guo*

674