CONTENTS

Host Chapter		xiv
Conferences a	and Expositions Committee and Transactions Staff	xiv
State of the So	ociety, Ron Jarnagin, 2011–2012 ASHRAE President	XV
Technical Pro	gram	xvii
	CONFERENCE PAPERS	
CH-12-C001	Under-floor Pressure Control: A Superior Method of Controlling Data Center Cooling	
011 12 0001	David Moss	3
	David Moss	
CH-12-C002	Data Center Air Energy Recovery Techniques	
	John Peterson, Douglas McLellan, and Ecton English	11
CH-12-C003	The Prospect of Hydrothermal Net-Zero Energy Data Centers	
011 12 0000	Tadeusz (Ted) Jagusztyn	19
CH-12-C004	Real Time Optimization of Building Combined Heat and Power Systems	
	Payam Delgoshaei, Stephen Treado, and Andrew Windham	27
CH-12-C005	Cold Climates Heat Pump Design Optimization	
	Omar Abdelaziz and Bo Shen	34
CH-12-C006	Residential Ground Source Heat Pumps with Integrated Domestic Hot Water Generation:	
	Performance Results from Long-Term Monitoring	40
	Dave Stecher and Kate Allison	42
CH-12-C007	Large Scale Residential/Municipal RES Integrated Refurbishment Construction	
	and HVAC Systems Engineering R&D Needs	
	Marija Todorovic	50
CH-12-C008	Status of Renewable Energy Systems in the United States	
	Kent W. Peterson	58
CH-12-C009	The Role of Solar and Other Renewable Energy Sources on the Strategic Energy Planning:	
	AFRICA's Status & Views	C 4
	Essam E. Khalil	64
CH-12-C010	Renewable Energy Sources within Urban Areas: Results From European Case Studies	
	Ursula Eicker	73
CH-12-C011	Integrated Building Design in Tropical Climates:	
CH-12-C011	Lessons Learned from the ENERPOS Net Zero Energy Building	
	François Garde, Eric Ottenwelter, and Alain Bornarel	81
CH-12-C012	Integrated Project Delivery: The Obstacles of Implementation	
	Amanda J. Fish and Julia Keen	90
CH-12-C013	Integrated Design-Build Delivery Team Achieves	
	Aggressive Building Energy Performance Goals	
	Duane Allen, Todd Stine, Jack Avery, Tom Marseille, Tom Boysen, Kimberly Paulson,	
	Charles Chaloeicheep, and Christopher Flint Chatto	98

CH-12-C014	Atrium Smoke Management Natural Venting Challenges Ray Sinclair and Xiangdong Du	106
CH-12-C015	How to Make a 155 Year Old Building a High Performance Building Michael Lubbehusen and Terry Thornsbury	119
CH-12-C016	Maximum Residential Energy Efficiency: Performance Results from Long-Term Monitoring of a Passive House Dave Stecher and Kate Allison	127
CH-12-C017	Field-Test of the New ASHRAE/CIBSE/USGBC Performance Measurement Protocols for Commercial Buildings: Basic Level Hyojin Kim and Jeff S. Haberl	135
CH-12-C018	Energy Audit Analysis of Residential Air-Conditioning Systems in Austin, Texas Joshua Rhodes, Brent Stephens, and Michael E. Webber	143
CH-12-C019	Using CUSUM Method to Detect Faults in Secondary HVAC Systems Zhengwei Li, Christiaan J. Paredis, and Godfried Augenbroe	151
CH-12-C020	Improving the Energy Performance of a University Building through Fault Detection and Building Systems Diagnostics Zara Fahim and Xinlei Wang	159
CH-12-C021	Use of First Law Energy Balance as a Screening Tool for Building Energy Data: Part II—Experiences of Its Implementation as a Data Quality Control Tool Juan-Carlos Baltazar, David E. Claridge, Jing Ji, Hiroko Masuda, and Song Deng	167
CH-12-C022	Maintenance and Repair of Building 4, Fort Benning, Georgia: Bringing Integrated Design to Existing Buildings Patrick Castelvecchi and Robert Mayfield	175
CH-12-C023	A Case Study: Using Integrated Approach to Design a Net-Zero Bank Branch Rahul Athalye, Yulong Xie, Bing Liu, and Michael Baechler	183
CH-12-C024	Comprehensive Climate Analysis & Passive Architecture to Achieve a Net-Zero Laboratory Alissa Feucht and Joshua Gassman	191
CH-12-C025	Experimental and Computational Investigation of Flow Regimes and Thermal Patterns in a Subway Station Essam E. Khalil and Esmail M. El-Bialy	199
CH-12-C026	Exhibition and Congress Halls Sustainable Design Brian Warwicker and Dan Cash	207
CH-12-C027	Occupancy of Australian Office Buildings: How Accurate Are Typical Assumptions Used in Energy Performance Simulation and What is the Impact of Inaccuracy Aileen Marie (Annie) Egan	217
CH-12-C028	Regression Models for Estimating Monthly Energy Consumptions in Schools in Hot and Humid Climates	
	Nabil Nassif	225

CH-12-C029	Occupancy Based Heating/Cooling for Low Energy Affordable Housing in Hot-Humid Climat Simge Andolsun and Charles Culp	
CH-12-C030	Withdrawn	
CH-12-C031	Domestic Hot Water System Performance Improvement at a Large University Campus Hui Chen, Homer Bruner, Jr., Robert Henry, Les Williams, and James Riley	241
CH-12-C032	A New Approach to Modeling the Energy Performance of Hydronic Systems with Pressure Dependent Control Valves McHenry Wallace Jr.	249
CH-12-C033	Neural Networks Approach for Energy Consumption in Air-Conditioned Administrative Buildi Essam E. Khalil, Ahmed A. Medhat, Samy M. Morkos, and Mohamed Y. Salem	-
CH-12-C034	The Impact of a Combined Dynamic Shading System on the Thermal Performance of Building Perimeter Zones Sagar Rao and Athanasios Tzempelikos	265
CH-12-C035	Design and Application Considerations for Smoke Management Fans Robert Z. Smith	273
CH-12-C036	Commissioning, Field Testing, and Maintenance of Fans for Life Safety Applications in Tunn Michael J. Feuser	
CH-12-C037	An Innovative Dedicated Outdoor Air Application for a Government Office Tower Michael Hallenbeck	285
CH-12-C038	Metal-Foam Enhanced PCM Storage System: the Cylinder-in-Cylinder Geometry Nihad Dukhan and Chun-Long Chen	293
CH-12-C039	Ongoing Commissioning Based on BMS Data Logs Yiming Feng, Cheng Chang, and Qingpeng Wei	301
CH-12-C040	Central Plant Energy Savings by Operator Training Brandon S. Field and David Ellert	309
CH-12-C041	AHRI Standard 550-590 Overview of Latest Updates Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cyc Saunders Smith	
CH-12-C042	Easy-to-Use Methods for Multi-Chiller Plant Energy and Cost Evaluation Stephen W. Duda	325
CH-12-C043	The Current State of Energy Retrofits for Small and Medium Buildings Timothy C. Wagner	333
CH-12-C044	Retrofit Energy Efficiency Modeling, Assessments, and Integrated Technologies: Seeking Solutions for Small and Medium Sized Buildings Richard Sweetser	341
CH-12-C045	Advancing from the Current State of Energy Retrofits to the Future State James Freihaut and Paul Hallacher	

CH-12-C046	In-Field Performance of Condensing Boilers Lois B. Arena, Thomas A. Butcher, William A. Zoeller, and Carl R. Shapiro	359
CH-12-C047	Ductless Task Air-Conditioning Tim Law, Jane Sargison, Roger Fay, and Steven Banbury	367
CH-12-C048	An Experimentally Validated Modeling of Refrigerant Distribution in a Parallel Microchannel Evaporator Hanfei Tuo, Algirdas Bielskus, and Pega Hrnjak	375
CH-12-C049	Exploring Alternatives to the "Typical Meteorological Year" for Incorporating Climate Change into Building Design Shannon L. Rabideau, Ulrike Passe, and Eugene S. Takle	384
CH-12-C050	Practical and Policy-Relevant Performance Metrics for Complex Fenestration Systems Shreya Dave and Marilyne Andersen	392
CH-12-C051	A Comprehensive Review of Radiant Barrier Research Including Laboratory and Field Experiments Mario A. Medina	400
CH-12-C052	Toward Net-Zero Energy Labs in Northern Climate—Montreal Examples Roland Charneux	408
CH-12-C053	Cooling System Design for Data Centers Utilizing Containment Architecture Davis Wilson	415
CH-12-C054	Multiple-Zone Variable Refrigerant Flow System Modeling and Equipment Performance Mapping Bo Shen and C. Keith Rice	420
CH-12-C055	Multi-Zone Test Facility for Variable Capacity Multi-Split Heat Pump Systems Harshal Upadhye, Ron Domitrovic, and Ammi Amarnath	428
CH-12-C056	Energy Efficiency, Air Flow Regime and Relative Humidity in Air-Conditioned Surgical Operating Theatres Essam E. Khalil	436
CH-12-C057	Assessment of Health-Care Worker Exposure to Pandemic Flu in Hospital Rooms U. Ghia, S. Konangi, A. Kishore, M. Gressel, K. Mead, and G. Earnest	442
CH-12-C058	Control of Space Pressurization for Sealed or Tight Rooms James Coogan	450
CH-12-C059	Legislative Aspects of Enforcing Renewables Integration and Success of Implementation Hywel Davies	458
CH-12-C060	Developing Advanced Virtual Models of Combined Buildings and Systems for Energy Reduction and Integrating Renewables	464
CH-12-C061	Andy Ford, Ian Butterss, and Tim Brown Performance Evaluation of the Centre for Efficient and Renewable Energy in Buildings	
	Jeya Bavan and Tony Day	471

CH-12-C062	An Analysis of Photovoltaic Performance on Fire Station Buildings in London Tony Day and Dan Clark	479
CH-12-C063	Applications of Low Temperature Fluid (LTF) in Thermally Stratified Thermally Stratified Thermal Energy Energy Storage (TES)	
	John S. Andrepont	487
CH-12-C064	The Challenges of Treating Large Thermal Storage and District Cooling Systems Robert S. Walicki, F. Philip Yu, and Danny Blagojevich	495
CH-12-C065	Control of Corrosion, Microbiology & Deposition in Large Thermal Chilled Water Storage Systems, A System Management Perspective Henry Becker and Jon Cohen	500
CH-12-C066	Renewable Energy Utilization in Chinese Buildings: Technology Development and Demonstration Projects Ming Shan, Ming Yang, and Xudong Yang	
CH-12-C067	Renewable Energy Policy Initiatives in UAE and Pakistan Farooq Mehboob	514
CH-12-C068	Hydrothermal Energy: Sustainable Benefits for Island and Coastal Communities Tadeusz (Ted) Jagusztyn	522
CH-12-C069	A Load-Aggregation Method to Calculate Extraction Temperatures of Borehole Heat Exchangers Johan Claesson and Saqib Javed	530
CH-12-C070	A Method to Evaluate Thermal Response Tests on Groundwater-filled Boreholes Saqib Javed, Helena Nakos, and Johan Claesson	540
CH-12-C071	Thermal Network Model for Variable Flow Ground Heat Exchanger Systems Wei Ruan and William Travis Horton	550
CH-12-C072	Ventilation Effectiveness of Building Cluster K.C. Tsui and Yuguo Li	558
CH-12-C073	Design of Practical Hybrid Ventilation Building in Central Tokyo Maria-Alejandra Menchaca-Brandan, Stephen Ray, and Leon R. Glicksman	567
CH-12-C074	Ventilation Approaches for Shopping Malls— An Examination of Natural and Hybrid Strategies David Hamlyn, Daniel Cash, Gwilym Still, Philip Armitage, and Shaun Fitzgerald	575
CH-12-C075	Energy Conservation through Filtration and Hydronic Free Cooling George Oranski and Scott Mayes	586
CH-12-C076	Optimizing Efficiency: Minimizing the Combined Energy Use of Fans and Ventilation Air Conditioning	
	Roger Chang, Omar Hawit, and Chris Wilson	594
CH-12-C077	Influence of Filter Fiber Material on Removal of Ultrafine and Submicron Particles Using Carbon Fiber Ionizer-Assisted Intermediate Air Filters	
	Bingbing Shi, Lars E. Ekberg, Anders Trüschel, and Jan Gustén	602

CH-12-C078	Comparison of Simplified Computational Methods of Flexibility Analysis to Determine Thermally Developed U-bend and L-bend Anchor Forces Sean Robinson and D. Scott Fisher	612
CH-12-C079	Low Outdoor Temperature Heat Pump Applications to Reduce Electric Resistance Second Stage Heat John Bush, Ron Domitrovic, and Ammi Amarnath	620
CH-12-C080	Advanced Unitary HVAC Control Sequence Reid Hart	
CH-12-C081	Design Fires for Road Tunnels Safety Design A. Kashef, J. Viegas, A. Mos, and N. Harvey	636
CH-12-C082	NYCT R-142 Train Design Fire Scenario Characteristics J. Greg Sanchez	644
CH-12-C083	A New Approach to Determining Passenger Rail Vehicle Design Fires Jeffrey Tubbs, Jarrod Alston, Matthew Johann, Brian Meacham, Nicholas Dembsey, and Kurt Schebel	650
CH-12-C084	Modeling of Household Refrigerator Performance with Low Global Warming Potential Alternative Refrigerants Daniel Leighton, Yunho Hwang, and Reinhard Radermacher	658
CH-12-C085	Low GWP R-404A Alternatives for Commercial Refrigeration Barbara Minor and Ward Wells	666
CH-12-C086	Experimental Study of Refrigerant Two Phase Separation in a Compact Vertical T-junctio Hanfei Tuo and Pega Hrnjak	
	TECHNICAL PAPERS	
CH-12-001	Heat Pump Water Heater Technology Assessment Based on Laboratory Research and Energy Simulation Models Kate Hudon, Bethany Sparn, Dane Christensen, and Jeff Maguire	683
CH-12-002	Simulation Modeling of a Central Chiller Plant Kirby Nelson	705
CH-12-003	Simulation Modeling of Central Chilled Water Systems Kirby Nelson	724
CH-12-004	Withdrawn	
CH-12-005	Withdrawn	
CH-12-006	An Empirical Thermal Comfort Model for Transient Metabolic Conditions Ahmet Ugursal and Charles H. Culp	742
CH-12-007	Net Zero Building Cluster Energy Systems Analysis for U.S. Army Installations Alexander Zhivov, Richard J. Liesen, Stephan Richter, Reinhard Jank, David M. Underwood, Dieter Neth, Alfred Woody, Curt Bjork, and Scot Duncan	751

CH-12-008	Extremely Low Energy Design for Army Buildings: Barracks	
	Richard J. Liesen, Peter Ellis, Alexander Zhivov, and Dale Herron	767
CH-12-009	Extremely Low-Energy Design for Army Buildings: Dining Facility	
	Michael Deru, Rois Langner, Alexander Zhivov, Richard Liesen, Dale Herron, and Vernon Smith	790
CH-12-010	Extremely Low-Energy Design for Army Buildings: Tactical Equipment Maintenance Facility	
	Rois Langner, Michael Deru, Alexander Zhivov, Richard Liesen, and Dale Herron	816
CH-12-011	Effect of Hybrid Ventilation System on Indoor Environment and Annual Cooling Load in a High-Rise Building	
	Katsuhiro Miura, Yuichi Takemasa, Masahiro Katoh, and Masaya Hiraoka	831
CH-12-012	Ventilation Rate Investigations in Minnesota Bars and Restaurants	
	David L. Bohac, Martha J. Hewett, Kristopher I. Kapphahn, and David T. Grimsrud	847
CH-12-013	Parametric Laboratory Evaluation of Residential Heat Pump Water Heaters	
	Paul Glanville, Douglas Kosar, and Daniel Suchorabski	853
CH-12-014	Measured Residential Hot Water End Use	
	Ben Schoenbauer, Dave Bohac, and Martha Hewett	872
CH-12-015	Water and Energy Wasted During Residential Shower Events: Findings from a Pilot Field Study of Hot-Water Distribution Systems	
	James D. Lutz	891
CH-12-016	Comparison of Heat Loss and Water Waste Characteristics of Bundles vs. Single Pipe Hot Water Distribution Systems	
	Carl C. Hiller	901
CH-12-017	Modeling the Performance of ECM and SCR Series Fan-Powered Terminal Units in Single-Duct VAV Systems	
	Michael A. Davis, John A. Bryant, and Dennis L. O'Neal	908
CH-12-018	Modeling the Performance of ECM and SCR Parallel Fan-Powered Terminal Units in Single-Duct VAV Systems	
	Michael A. Davis, John A. Bryant, and Dennis L. O'Neal	920
CH-12-019	Installation Effects on Air Outlet Performance, Part I: Ideal Performance-Testing Optimization and Results (RP-1335)	
	Brian Landsberger, Douglas Reynolds, and Zaccary Poots	930
CH-12-020	Installation Effects on Air Outlet Performance, Part II: Field Air Outlet Throw and Pressure Loss Performance Difference from Ideal (RP-1335)	
	Brian Landsberger, Douglas Reynolds, and Zaccary Poots	944
CH-12-021	Installation Effects on Air Outlet Performance, Part III: Field Air Outlet Sound Generation Performance Difference from Ideal (RP-1335)	
	Brian Landsberger, Douglas Reynolds, and Zaccary Poots	976

CH-12-022	A Model for Predicting Wireless Signal Transmission Performance of ZigBee-Based Sensor Networks in Residential Houses	
	Hui Li, Lingying Zhao, Peter Ling, and Jia Liu	994
CH-12-023	A Proposed Method of Test for Spoilage of Fruits and Vegetables	
	Kristopher R. Lineberry, Michael Pate, and Byron Brehm-Stecher	1008
CH-12-024	A Virtual Chilled-Water Flow Meter Development at Air Handling Unit Level	
	Atul Swamy, Li Song, and Gang Wang	1013
CH-12-025	Withdrawn	
CH-12-026	Evaluation of ASHRAE Dilution Models to Estimate Dilution from Rooftop Exhausts	
	Amit Gupta, Theodore Stathopoulous, and Patrick Saathoff	1021
CH-12-027	Feasibility of Foundation Heat Exchangers for Residential Ground Source Heat Pump Systems in the United States	
	James R. Cullin, Lu Xing, Edwin Lee, Jeffrey D. Spitler, and Daniel E. Fisher	1039
CH-12-028	Withdrawn	
CH-12-029	Literature Review of the Effect of Temperature and Humidity on Viruses	
	Farhad Memarzadeh	1049
CH-12-030	Measurements of Pipe Insulation Thermal Conductivity at Below Ambient Temperatures F Experimental Methodology and Dry Tests (RP-1356)	Part I:
	Lorenzo Cremaschi, Shanshan Cai, Kasey Worthington, and Afshin J. Ghajar	1061
CH-12-031	Withdrawn	
CH-12-032	Passive Houses: What May Happen When Energy Efficiency Becomes the Only Paradigm?	?
	H. Hens	1077
CH-12-033	Effect of Condensation Temperature and Water Quality	
	on Fouling of Brazed-Plate Heat Exchangers (RP-1345)	4000
	Lorenzo Cremaschi, Atharva Barve, and Xiaoxiao Wu	1086
CH-12-034	Measurements of Frost Growth on Louvered Folded Fins of Microchannel Heat Exchangers, Part 1: Experimental Methodology (RP-1589)	
	Tommy Hong, Ehsan Moallem, Lorenzo Cremaschi, and Daniel E. Fisher	1101
CH-12-035	Experimental Evaluation of Air-Side Particulate Fouling Performance of Heat Exchangers	
	Yigang Sun, Yuanhui Zhang, Douglas Barker, Steve Ford, and Mark Johnson	1116
CH-12-036	Laboratory Testing of Saddle-Tap Tees to Determine Loss Coefficients	4404
	A.N. Nalla and S. Idem	1131
CH-12-037	Measurements of Flat Oval Diverging-Flow Fitting Loss Coefficients (RP-1488) D.C. Gibbs and S. Idem	1146
Index 10 1		
index of Confe	erence and Technical Papers, Volume 118, Part 1	1154