

ENGINEERING SUSTAINABILITY 2017

INNOVATION AND THE TRIPLE BOTTOM LINE

April 9-11, 2017

Attendee Information

Convention Center WIFI

To gain free access to the DLLCC WIFI select “**engineering sustainability**” as your network and use the password “**mcsi2017**” (all lowercase).

WHOVA Program App

Whova is being utilized to guide you throughout the conference. You can use Whova to browse the event schedule, network with other attendees, scan and exchange business cards, all digitally via your mobile phone. To access the Whova Engineering Sustainability app please follow the instructions below.

Step 1: Download and install the Whova app from App Store (for iPhones) or Google Play (for Android phones).

Step 2: Sign up in the app using the email address you registered with.
Invitation code: “**ES17Pittsburgh**”

Step 3: You’re all set. Now enjoy!

Attendee List

In addition to the list on Whova, ES17 attendees may download a listing of all conference registrants in PDF format at www.engineering.pitt.edu/mcsi/ES2017

Conference Evaluation

Please go on-line to provide us with feedback on all aspects of the ES17 conference. The evaluation survey will be available through April 28 through the Whova app or at www.surveymonkey.com/r/es17conference

Green Building Certification Institute (GBCI)/ USGBC Continuing Education Credits

Many of the conference plenary and technical sessions are eligible for USGBC continuing education units. USGBC provides individuals with the ability to self-report CEUs. Go to www.usgbc.org to report your CE hours.

Proceedings

All conference oral and poster presenters have submitted extended abstracts which can be viewed by all conference attendees by going to www.engineering.pitt.edu/mcsi/2017-proceedings and use the password “**es17proceedings**”

Monday

8:30 - 9:30 • OPENING PLENARY, Room 407

Session Chair: Eric Beckman, University of Pittsburgh

Susan Handy, University of California Davis

The Future of Travel Demand

9:45 - 11:25 • Concurrent Session I: SUSTAINABLE ENERGY, Room 408

Session Chair: Kristen Parrish, Arizona State University

Tyler Harris, Clemson University

Logistic Growth Curve Modeling of U.S. Primary Energy Production Reveals Where Technology and Policy Fall Short, and Where Innovation is Required

John Stolz, Duquesne University

Turning Waste to Energy in Urban Communities: Biogester Technology in Pittsburgh

Zane McDonald, University of California, Davis

Systems Analysis and Techno-economic Assessment of Hydrogen Energy Storage via Electrolysis from Curtailed Renewables: A WECC Case Study

John Vernacchia, Eaton

The Socially Responsible Microgrid

9:45 - 11:25

Concurrent Session I: SUSTAINABLE BUILDINGS, Room 409

Session Chair: Annie Pearce, Virginia Tech

Tripp Shealy, Virginia Tech

How the Redesign of Rating Systems can Improve Sustainability

Jeremy Snyder, BuroHappold

Engineering Lessons Learned – Living Building Challenge Projects

Rebekah Burke, Arizona State University

I Can See Clearly Now: Illuminating the Material Selection Process for High Performance Buildings

Brock Glasgo, Carnegie Mellon University

Assessing the Value of Information in Residential Building Simulation: Comparing Simulated and Actual Building Loads at the Circuit Level

9:45 - 11:25 • Concurrent Session I: SUSTAINABLE WATER, Room 410

Session Chair: Jeanne VanBriesen, Carnegie Mellon University

Elizabeth Wronko, Rochester Institute of Technology

Geospatial Risk Analysis and Freshwater Ecotoxicity Assessment of Potential Nanomaterial Release in the Great Lakes Region

Dan Flannery, Villanova University

Reversing Development Impacts through Green Infrastructure Restoration: Establishing a Baseline

Anurag Mantha, Virginia Tech

Lessons Learned from Intensively Sampling Residential Water Heaters in Flint, MI

Robert Korenic, Youngstown State University

Youngstown State University “Gateway Project” Rain Garden Design Upgrades



11:30 - 12:30 • INVITED SESSION I: A, Room 408

Session Chair: David Riley, Pennsylvania State University

Anu Ramaswami, University of Minnesota

Urban Infrastructure Transformations Toward Sustainable, Healthy and Equitable Cities

Sean Qian, Carnegie Mellon

Big Data Analytics for sustainable mobility

11:30 - 12:30 • INVITED SESSION I: B, Room 409

Session Chair: Dave Dzombak, Carnegie Mellon University

Catherine Peters, Princeton University

Environmental Geochemistry Perspectives on Subsurface Energy Technologies

Rachel Brennan, Pennsylvania State University

Food, Energy, and Water for 11 Billion: The Need for Resource Recovery Through Engineered Ecological Infrastructure

12:30 - 1:40 • LUNCH PLENARY, Room 413-415

Session Chair: Eric Beckman, University of Pittsburgh

Brent Stephens, Illinois Institute of Technology

Indoor Exposures to Outdoor Air Pollution

1:45 - 3:00 • Concurrent II: AIR, Room 408

Session Chair: Kristen Parrish, Arizona State University

Torkan Fazli, Illinois Institute of Technology

Development of a Nationally Representative Set of Combined Building Energy and Indoor Air Quality Models for U.S. Residences

Yewande Abraham, Pennsylvania State University

A Case Study on Indoor Environmental Quality in a U.S. Residential Building

Melissa Bilec, University of Pittsburgh

Indoor Air Quality Tests in Multiple Pittsburgh Buildings

1:45 - 3:00 • Concurrent Session II: SUSTAINABLE WATER, Room 409

Session Chair: Dave Dzombak, Carnegie Mellon University

Lauren Cook, Carnegie Mellon University

A Framework for Incorporating Downscaled Climate Output into Existing Engineering Methods: Application to Precipitation Frequency Curves

Kasparas Spokas, Princeton University

Geologic Carbon Storage and Leakage Risks

Michael German, Lehigh University

A New Sustainable Route to Age-old Softening: Less Chemicals, Less Sodium at Thermodynamic Efficiency

1:45 - 3:00 • Concurrent II: EDUCATION, Room 410

Session Chair: Dave Sanchez, University of Pittsburgh

David Riley, Pennsylvania State University

An Engaged Scholarship Approach to Solar Energy Deployment at Community Wells

Benjamin Chambers, Virginia Tech

BioBuild: Developing an Interdisciplinary Graduate Course Bridging the Sciences of Biology and the Built Environment

Mark Minster, Rose-Hulman Institute of Technology

Testing the Triple Bottom Line: Students, Sustainability, and Hydropower

3:05 - 4:15 • Concurrent III: FOOD, Room 408

Session Chair: Vikas Khanna, University of Pittsburgh

Leanne Gilbertson, University of Pittsburgh

Leveraging Nanotechnology to Advance Agriculture Sustainability: Life Cycle Considerations and Recommendations

Dana Boyer, University of Minnesota

Are there Water and Greenhouse Gas Emissions Co-Benefits to City-Scale Food System Actions? Exploring Coupled Water and GHG Footprinting of Future Urban Food Scenarios

Nemi Vora, University of Pittsburgh

Food-Energy-Water Nexus: Quantifying Embodied Energy and Greenhouse Gas Emissions in Virtual Water Transfers

3:05 - 4:15

Concurrent Session III: SUSTAINABILITY INDUSTRY PANEL, Room 409

Moderated by the University of Pittsburgh Center for Supply Chain Management

Eric Paljug and **Teresa Leatherow** (Moderators)

Mark Cancilla, Vice President EHS, PPG

Geoffrey Muessig, EVP & Chief Marketing Officer, PITT OHIO

Frank O'Brien-Bernini, VP & Chief Sustainability Officer, Owens Corning

3:05 - 4:15 • Concurrent III: CASE STUDIES, Room 410

Session Chair: Rodolfo Valdes Vasquez, Colorado State University

Rachael Sherman, Arizona State University

Small Buildings, Big Impacts: the Role of Small Commercial Building Energy Efficiency Case Studies in 2030 Districts

Harold Rickenbacker, University of Pittsburgh

Creating Environmental Consciousness in an At-Risk Community through Civic Engagement Strategies and Resident-Inclusive Mobile Air Quality Monitoring

Patricia Culley, Bohlin Cywinski Jackson

Equity by Nature – The Story of the Frick Environmental Center

4:30 - 6:00 • POSTER SESSION & SOCIAL, Garrison Overlook

Tuesday

8:30 - 9:30 • OPENING PLENARY, Room 407

Session Chair: *Dave Dzombak, Carnegie Mellon University*

Mike Walsh, MetroQuest

Sustainability Applied: Using Smart Cities as a Framework for Engineers to Implement Sustainability

9:45 - 10:45 • INVITED SESSION II: A, Room 408

Session Chair: *Melissa Bilec, University of Pittsburgh*

Amy Landis, Clemson

Water Quality: The Often Ignored Consequences of Emerging Technologies

Callie Babbitt, Rochester Institute of Technology

Applying Circular Economy Principles to the Lithium-Ion Battery Waste Management Hierarchy

9:45 - 10:45 • INVITED SESSION II: B, Room 409

Session Chair: *Annie Pearce, Virginia Tech*

John Little, Virginia Tech

Rapid Methods to Estimate Exposure to SVOCs in the Indoor Environment

Kyle Bibby, University of Pittsburgh

Source to Tap: What Shapes Microbial Communities in Our Drinking Water?

10:50 - 12:30

Concurrent Session IV: SUSTAINABLE ENERGY, Room 408

Session Chair: *David Riley, Pennsylvania State University*

Ilke Celik, University of Toledo

Installing Emerging Photovoltaic Cells on Pervious and Impervious Surfaces: Toxicity Implications on Soil and Fresh Water Compartments

Nicole Ryan, University of Michigan

Life Cycle Environmental Impacts of Using Lithium Ion Batteries for Power System Reserves and Strategies for Mitigation

Nichole Hanus, Carnegie Mellon University

Measuring Pv Technical Potential and Financial Feasibility for Educational Buildings in the United States

Kevin Ketchman, University of Pittsburgh

Disaggregating Small Commercial End-Use Energy Using a Novel Bottom-up Approach

10:50 - 12:30

Concurrent Session IV: SUSTAINABLE BUILDINGS, Room 409

Session Chair: *Leidy Klotz, University of Virginia*

Rodolfo Valdes-Vasquez, Colorado State University

The Current Status of Green Design and Construction Related to Fire Stations in the U.S.

Nathan Kegel, IES

Climate Change: Impacts on Building Energy Use Intensity

Samaneh Gholitabar, New York University

Mapping Wind Energy Potential in New York City Using Geographic Information System Platform and Semi-Analytical Methods

Robert Phillips, Northeastern University

Modeling the Triple Bottom Line in Commercial Buildings

10:50 - 12:30 • Concurrent Session IV: SUSTAINABLE WATER, Room 410

Session Chair: *Kyle Bibby, University of Pittsburgh*

Michael Shreve, Pennsylvania State University

Fungal Diversity and Trace Organic Contaminant Removal in Six Full-Scale Integrated Fixed-Film Activated Sludge (IFAS) Wastewater Treatment Plants

Madeline Foley, Villanova University

Integration of Triple Bottom Line Integrators to Prioritize Stormwater Management Infrastructure

Kerim Dickson, Carnegie Mellon University

Sustainable Management of Water Resources in the U.S.: Interbasin Transfers and their Drivers

Annie Pearce, Virginia Tech

Developing a Multi-layer Water Network Model



12:35 - 1:40 • LUNCH PLENARY, Rooms 413-415

Session Chair: *Dave Dzombak, Carnegie Mellon University*

Amy Pruden, Virginia Tech

Answering the Call: The Need for Modern Academics to Step Up as Leaders in Addressing Our Failing Water Infrastructure

1:45 - 3:30

Concurrent Session V: SUSTAINABLE BUILDINGS, Room 408

Session Chair: *Leanne Gilbertson, University of Pittsburgh*

Sandeep Langar, The University of Southern Mississippi

Design of a Resilient Building: An Assessment of Designer Knowledge

Justin Henriques, James Madison University

A Framework For Analyzing Climate Change Vulnerability in the Built Environment

Rohini Srivastava, Carnegie Mellon University

Decision Maker's Response to Triple Bottom Line Cost Benefits of Energy Efficiency

Laura Nettleton, Thoughtful Balance

Passive House: The Affordable Path to Net Zero Energy

1:45 - 3:30

Concurrent Session V: SUSTAINABLE TRANSPORTATION, Room 409

Session Chair: *David Sanchez, University of Pittsburgh*

Isaac Smith, Green Building Alliance

Make My Trip Count: The Impact of How Pittsburghers Commute

Ashwin Kumar Balaji, Carnegie Mellon University

Shared Wireless Charging Infrastructure Model for Electric Vehicles

Brianna Lawton, Morgan State University

Life Cycle Cost Analysis Framework for Evaluating Resilient Modulus Testing Strategies used for Characterization and Design of Sustainable Roadway Infrastructure

Greg Schivley, Carnegie Mellon University

Environmental Implications of Autonomous Electric Vehicle Adoption and Use Patterns

POSTER SESSION & SOCIAL, Garrison Overlook

- Maria Saxton, Virginia Tech, Micro Home Communities: Potential Incubators for a Sustainable and Resilient Society**
- Thomas Kasun, Arconic, Natural Engineered Wastewater Treatment (NEWTTM) System at Alcoa Joint Venture Facility at Saudi Arabia**
- Abdullah Al Arfaj, Carnegie Mellon University, Projecting Diffusion of Alternative Mobility Technologies and the Implications for Sustainability**
- Pragnya Eranki, Clemson University, A Comparative Life Cycle Assessment Using Experimental Field Data of Flood Vs. Drip Irrigation in Guayule Rubber Cultivation**
- Ozgul Calicioglu, Pennsylvania State University, Maximizing Carboxylic Acid Yields from Duckweed using Acidogenic Digestion with Mixed Anaerobic Cultures**
- Ozgul Calicioglu, Pennsylvania State University, Improvement of Bioenergy Yields Obtained from Duckweed by Sequential Ethanol Fermentation and Anaerobic Digestion**
- William Collinge, University of Pittsburgh, Comparison of Two "Green" Buildings Using Real-Time Data in a Dynamic LCA Framework**
- Clara Eichler, Virginia Tech, Air/Product Equilibrium Relationships for SVOCs in Consumer Products**
- Jeremy Snyder, BuroHappold Engineering, Redefining Occupant Behavior and Comfort through Analytics**
- Adam Cadwallader, Carnegie Mellon University, Incorporating Uncertainty Into National Estimates of Nitrous Oxide Emissions from Centralized Wastewater Treatment**
- Barbara Astmann, Clemson University, Reduction and Solubilization of Bioplastics to Enhance Degradation**
- Tyson Merkey, Colorado State University, Understanding the Implementation of Water Reuse Technologies for LBC projects and its Applicability in the State of Colorado**
- Reza Foroughi, Pennsylvania State University, The Application of Biomimicry to Design a Multi-functional Building Facade for Existing Commercial Buildings**
- Vaclav Hasik, University of Pittsburgh, Models, Methods, and Metrics for Design of Sustainable and Resilient Buildings**
- MiguelAndres Guerra, Virginia Tech, Design Theory Evolution for Sustainable Infrastructure System Design: A Synthesis of Literature and Applications**
- Ali Karakhan, Oregon State University, Investigation of the Human Element of Sustainability in the Built Environment**
- Raeanne Clabeaux, Clemson University, Calculating the Carbon Footprint of Clemson University's Campus**
- Akshay Patil, Carnegie Mellon University, An approach to Improve Building Energy Efficiency Using Machine Learning Techniques.**
- Kate Hancock, GTECH Strategies, Sustainable Return on Investment in the Greater Pittsburgh Region**
- Devesh Mohan, Iowa State University, Addressing World Food Shortage Through Vertical Farming and Efficient Microgrid Design**
- Sara Ghahramani, Pennsylvania State University, Evaluation of Carbonation Shrinkage in Alkali-Activated Slag (AAS) Concrete**
- Tony Kerzmann, Robert Morris University, Demographics-Based Simulation for Optimized Alternative Fueling Station Locations in the Pittsburgh Area**
- Naga Goteti, Rochester Institute of Technology, Carbon Implications of Energy Storage in Grids with Expanded Wind and Solar Energy**
- Emily Klonicki, University of Pittsburgh, Evaluation of Low-Cost Carbon-Felt Based Microbial Fuel Cells with Undiluted Manure for Remote Charging Applications**
- Vanessa Guerra M, Virginia Tech, The Extent of Informal Car-Share (ICS) in Quito, Ecuador**
- Sheikh Moni, Clemson University, Life Cycle Assessment of Emerging Technologies: A Case Study of Biofuels Via Fast Pyrolysis of Sweet Sorghum**
- Teresa Leatherow, University of Pittsburgh, The Supply Chain: A Systems-based Approach to Sustainability**
- Nora Harris, Virginia Tech, Why Energy Management and Information Systems Aren't Enough: An Implementation Case Study**
- Maryam Hojati, Pennsylvania State University, Influence of Steam Curing on Drying Shrinkage of Alkali-Activated Binders Made without Portland Cement**

- Jonathan Callura, Carnegie Mellon University, Development of Novel Adsorbents for Sustainable Separations of Rare Earth Elements**
- Taofeeq Ibn-Mohammed, University of Sheffield, Building Energy Retrofits: Computed Optimized Building Retrofit Advice (COBRA)**
- Dmitry Liapitch, Rochester Institute of Technology, Evaluating Products and Services by Using the Triple Bottom Line of Sustainability**
- Priya Donti, Carnegie Mellon University, Predicting and Explaining Marginal Generators in Real Time**
- Dalya Ismael, Virginia Tech, Perceptions of Sustainable Design and Construction in Kuwait: A Country That Per Capita Contributes 66% More Global Greenhouse Gas Emissions than the United States**
- Zachary Miller, University of Pittsburgh, Sustainable Water Treatment for Aquaculture: An Evaluation of Carbon-Based Electrocatalytic Production of Hydrogen Peroxide for the Removal of Geosmin in Aquaculture Systems**
- Emma Coleman, Clemson University, Perception of Tiny Houses as a Sustainable Living Option**
- Benjamin Roman, Pennsylvania State University, Modeling Nitrogen Transformations in an Ecological Wastewater Treatment System to Optimize Duckweed Growth for Food Productions**
- Lisa Stabryla, University of Pittsburgh, Understanding the Interaction Between Nanomaterials and Bacteria to Inform Design of Next-Generation Antimicrobials**
- Armin Jeddi Yeganeh, Virginia Tech, An Introduction to the Link Between Micro-Zoning, Indoor Environmental Quality, and Occupants' Health and Productivity in Office Building Design**
- Kelly Good, Carnegie Mellon University, Evaluation of Bromide Concentration Contributions from Coal-Fired Power Plants in the Allegheny River Basin Using Current and Future Scenarios**
- Rodolfo Valdes-Vasquez, Colorado State University, Assessing the Perception of Compressed Earth Block (CEB) Among General Contractors in the Piedmont Region of North Carolina**
- Pan Ji, Virginia Tech, Longitudinal Evaluation of The Impact of Heat Treatment on the Hot Water System Microbiome**
- Elyse Stachler, University of Pittsburgh, Development of crAssphage-based qPCR Assays for Source Tracking of Wastewater Pollution in Environmental Waters**
- Roksana Mahmud, Clemson University, Development of Sustainability Evaluator Interface to Determine Environmental, Economic and Social Impacts of Chemical Processes**
- Miranda Gorman, Carnegie Mellon University, A New Framework for Sustainable Mining**
- Yan Wang, University of Pittsburgh, Sustainable Design of Carbon Nanomaterials: Decoupling the Role of Materials Structure and Surface Chemistry on Electrochemical and Biological Activity**
- Shahana Althaf, Rochester Institute of Technology, The "Evolving Ton" of Electronic Waste: Challenges and Opportunities for Recycling Infrastructure in the United States**
- Min Jae Suh, Sam Houston State University, Finite Element Method Based Numerical Simulation of the Thermodynamic Process of a Single Stage Solar Absorption Chiller**
- Min Jae Suh, Sam Houston State University, Adapting a Traditional Korean Radiant Underfloor Flooring Heating System for U.S. Fireplaces: An Integrated Design Approach**
- Long Lam, Carnegie Mellon University, A Sunny Future? Expert elicitation of China's Solar Photovoltaic Technologies**
- Parham Azimi, Illinois Institute of Technology, Development and Application of a Complex Infection Transmission Model for Predicting Influenza Exposures in Indoor Environments**
- Mahsa Safari, Pennsylvania State University, Education and Outreach Integration to Initiate Building Energy Retrofits**
- Dan Li, Virginia Tech, Sustainable by Design Using SITES? Exploring the Role of SITES in Sustainable Landscape Design Projects in the United States**
- Chukwuma Nnaji, Oregon State University, Impact of Technology on Sustainability in the Construction Industry: Case Study of Construction Work Zone Safety**

- Avi Mersky, Carnegie Mellon University, Combining Municipal Fleet Vehicle Electrification and Photovoltaic Power: A Case Study in Pittsburgh, PA**
- Sanjeev Adhikari, Indiana University – Purdue University Indianapolis, Analysis of Low Cost and Energy Efficiency of HFH Home**
- Jennifer Russell, Rochester Institute of Technology, Using Systems-Perspective to Understand Infrastructure Barriers to Increased Remanufacturing**
- Jiaoyang Yin, University of Pittsburgh, Leveraging Nanotechnology to Advance Agriculture Sustainability: Life Cycle Considerations and Recommendations Based on a Literature Review**
- Joe Moore, Carnegie Mellon University, Differential Antimicrobial Effects of and Bacterial Transcriptional Responses to Nanoparticulate Copper Oxide and Copper Ion Under Oxidic and Anoxic Conditions**
- Heinz Huber, RjLee Group, Indoor Air Quality Measurements Using Proton-Transfer-Reaction Mass Spectrometry (PTR-MS).**
- David Linamen, Stantec Architecture, Inc., Optimizing Chilled Beam Applications for HVAC in Laboratories**
- Anurag Mantha, Virginia Tech, Barriers to Sustainable Water Heating: An Industry Perspective**
- Mohamed Abdel-Raheem, University of Texas Rio Grande Valley, Red Mud as a Construction Material**
- Francis Jordan-Cuebas, Rutgers University, Understanding Apartment End-Use Water Consumption in Two Green Residential Multi-Story Buildings**
- Vasudevan Nambesan, Carnegie Mellon University, Design of a Molten Carbonate Fuel Cell Power System from Delhi Landfills**
- Saratu Terreno, Pennsylvania State University, The Impact of Information Waste on Sustainability Goals**
- Rebekah Martin, Virginia Tech, Potential Impacts of Water Heater System Design in Traditional and Green Buildings**
- Kenneth Sears, Carnegie Mellon University, Climate Change Impacts on Electricity Grid Capacity and Demand at the Load Serving Entity-Scale**
- Stella Osifo, Morgan State University, Impacts of rehabilitating Underground Utilities in a design built environment and Proffering a Sustainable Cost Effective Solution**
- Megan Fuller, Philadelphia University, Biochar Derived from Cotton Fabric Feedstock: Characterization of Material and Potential for Absorptive Capacity**
- Evan Sherwin, Carnegie Mellon University, Do Low-Income Electricity Subsidies Make Consumption More Peaky?**
- Nathan McWhirter, Virginia Tech, Teaching Engineering Design for Sustainability Through An Envision Case Study: An Approach to Overcome Cognitive Bias During Decision Making for Infrastructure**
- Zhuoyi Zhang, University of Virginia, Impact of Ridesharing on Operational Efficiency of Shared Autonomous Electric Vehicle Fleet: A Seattle Case Study**
- Tobias Müller, Villanova University, Resiliency of Urban Stormwater Control Measures: Case Study of Infiltration Trench Failure and Subsequent Redesign**
- Jacob Metch, Virginia Tech, A Global Survey of Antibiotic Resistance Gene in Wastewater Treatment Plants**
- Rohini Srivastava, Carnegie Mellon University, Investing in Building Energy Efficiency to Preserve Natural Capital and Human Capital**
- Cassandra Thiel, New York University, From Scoping to Interventions: Creating Emissions Reduction Strategies in Medicine**
- Heather Hunter, Princeton University, Removal of Metals from Wastewater Through Barite Precipitation**
- Yaoping Wu, Virginia Tech, Estimating Surface/Air Partition Coefficients for SVOCs in Interior Surfaces**
- Jacob Ward, Carnegie Mellon University, How Do Shared Mobility and Autonomous Taxis Affect Vehicle Ownership, Use and Emissions**
- Frederick Paige, Virginia Tech, Peggy's House, a Social Sustainability Case Study**
- Fan Tong, Carnegie Mellon University, A County-Level Assessment of Health and Climate Damages Cost for Light-Duty and Heavy Duty Vehicles**



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