



Hot Water Forum

Water Heating, Distribution, and Use Efficiency

Hilton Portland & Executive Tower • Portland, OR • February 26 - 28, 2017

PROGRAM

Sunday, February 26

3:00 – 7:00 pm	REGISTRATION OPEN	<i>Plaza Foyer</i>
5:00 – 7:00 pm	RECEPTION	<i>Plaza Foyer</i>

Monday, February 27

7:30 am – 7:30 pm	REGISTRATION OPEN	<i>Plaza Foyer</i>
8:00 – 9:00 am	CONTINENTAL BREAKFAST	<i>Pavilion East</i>
9:00 – 10:30 am	WELCOME, INTRODUCTIONS, AND PLENARY PANEL	<i>Pavilion West</i>

ACEEE Welcome and Introductions: **Chris Perry**, American Council for an Energy-Efficient Economy

Welcome from Co-Hosts: **Joshua Green**, A.O. Smith
Karen Meyers, Rheem

Welcome from Major Funders: **Amy Bryan**, Jackson EMC
Jeff Pratt, Oglethorpe Power

Plenary Panel Discussion: The Changing Face of Water Heater Efficiency Ratings

Moderator: **Harvey Sachs**, American Council for an Energy-Efficient Economy

Speakers: **Ashley Armstrong**, US Department of Energy
Frank Stanonik, Air-Conditioning, Heating, and Refrigeration Institute
George Chapman, Consortium for Energy Efficiency

10:30 – 11:00 am	NETWORKING BREAK	<i>Plaza Foyer</i>
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11:00 am – 12:30 pm**BREAKOUT SESSIONS***Session 1A**Pavilion West***Grid-Enabled, Grid-Responsible, and Grid-Interactive Electric Thermal Storage Water Heating – The Foundation of Community Storage!**

Moderator: **Steven Koep**, Vaughn Thermal Corporation; Co-Chair, PLMA Behind-the-Meter Storage (BTMS) Interest Group

Utility Industry Policy Update - How We Got Here and Where We're Going

Speaker: **Keith Dennis**, National Rural Electric Cooperative Association

Is There a 'Policy-Gap' for Grid-Interactive Water Heating (GIWH) and Community Storage Technologies?

Speaker: **Robin Roy**, Natural Resources Defense Council

From Load Management to Distributed Resources to Community Storage: The Great River Energy Journey

Speaker: **Gary Connett**, Great River Energy

Where Is the SMART in Smart Grid Connected Water Heaters?

Speaker: **Bill Hosken**, A.O. Smith

Disrupt or Be Disrupted: GIWH, Community Storage, and Beneficial Electrification!

Speaker: **Steven Koep**, Vaughn Thermal Corporation; Co-Chair, PLMA Behind-the-Meter Storage (BTMS) Interest Group

Description: Electric water heating, as an integral part of the 'connected home' future, is an emerging reality for electric utilities across the country. Simultaneously, increasing amounts of variable renewable energy are being integrated into the grid. This changing landscape is leading to a variety of challenges and opportunities as stakeholders—including policymakers, utilities, environmental advocates, and manufacturers—work to balance their interests while meeting the demands of consumers and the market. Join us for a discussion of how policies and technologies interact and continue to evolve as we move from load management to community storage.

*Session 1B**Broadway I***CO₂ Combi System: Results from the Field and the Pacific Northwest National Laboratory (PNNL) Lab Homes**

Moderator: **Charlie Stephens**, Northwest Energy Efficiency Alliance

Combined Space and Water Heating Using Split-System CO₂ Refrigerant Heat Pump Water Heaters

Speaker: **Ken Eklund**, Washington State University

PNNL Lab Home Testing Results for the CO₂ Combi System

Speaker: **Cheryn Metzger**, Pacific Northwest National Laboratory

Description: Previous work has shown that CO₂ HPWHs have additional heating capacity that can be used for space heating. Over the past two years, Washington State University and PNNL have put this theory to the test. Come learn results from field studies and PNNL lab home experiments on these water heaters that offer a combination system. The speakers will cover energy savings potential, stress testing, demand response capability and lessons learned from the installation process. Project partners include Washington State University, PNNL, Bonneville Power Administration, Silicon Valley Power, and Sanden.

Session 1CBroadway II**Interactive Systems: Wring Out the Waste**

Moderator: **Gary Klein**, Gary Klein and Associates

Tub Technologies: Auto-Diverting Tub Spouts

Speaker: **Troy Sherman**, Evolve Technologies

Conserving Hot Water through Tub Spout Diverter Labeling

Speakers: **Richa Sharma**, US Environmental Protection Agency
Tessa Roscoe, ERG

Pump Efficiency Rule Making

Speaker: **Stephen Putnam**, Grundfos North America

The Impact of Pressure Drop

Speaker: **Gary Klein**, Gary Klein and Associates

Description: This session provides an overview of a few important aspects of water distribution. Join us to learn about new technologies that save wasted bathtub water. Speakers will also cover the impacts of the upcoming tub-spout diverter labeling program and uncover the true impact of pressure drop in a hot water distribution system.

Session 1DBroadway III**Today's Landscape of Residential Efficiency Programs**

Moderator: **Chris Granda**, Appliance Standards Awareness Project

Summary of Residential Energy Efficiency Water Heater Programs in 2016 across the US and Canada

Speaker: **Alice Rosenberg**, Consortium for Energy Efficiency

ENERGY STAR® Overview: Specification Updates and Consumer Outreach Campaign Successes

Speaker: **Steve Ryan**, US Environmental Protection Agency

Description: This session will provide a high-level snapshot of residential water heating efficiency programs, including heat pump water heaters (HPWHs), gas storage, gas tankless, Energy Policy Act (EPACT), indirect, hybrid, and solar programs. Consortium for Energy Efficiency staff will share findings from the 2016 Water Heating Program Summary, which provides data on trends such as financial incentive structures, promotion strategies, installation considerations, and financing approaches. A US EPA representative will present updates and recent developments on the new ENERGY STAR® water-heating program, including specification revision plans and outcomes from the 2016 consumer outreach campaign to promote efficient products.

12:30 – 1:30 pm

NETWORKING LUNCH

Pavilion East

1:30 – 3:00 pm**BREAKOUT SESSIONS**Session 2APavilion West**Grid-Interactive Water Heating: Control Providers Roundtable**Moderator: **Keith Dennis**, National Rural Electric Cooperative Association

Discussion Panelists: **Robert Warden**, Comverge
Joe Childs, Eaton
Matt Carlson, Aquanta
Laurie Vaudreuil, Mosaic Power
Clint Caudle, Carina Technologies
Paul Steffes, Steffes Corporation
Dan Flohr, Sequentric Energy Systems
Brian Zimmerly, SolarCity

Description: Grid-Interactive Water Heating (GIWH) is emerging as the low-hanging fruit of community energy storage technologies. Hear from control providers about the technologies and program models they are bringing to the community storage market.

Session 2BBroadway I**Gas Heat Pump Water Heating: Developments and Demonstrations**Moderator: **Paul Glanville**, Gas Technology Institute

Transforming the Gas Water Heating Market

Speaker: **Aaron Winer**, Northwest Energy Efficiency Alliance

Residential Combi-Space/Water Heating Gas Absorption Heat Pump System: Field Evaluation and Lessons Learned

Speaker: **Michael Garrabrant**, Stone Mountain Technologies, Inc.

Residential Gas Absorption Heat Pump Water Heaters: Field Trials and Extended Life Testing of Packaged Prototypes

Speaker: **Paul Glanville**, Gas Technology Institute

Description: This session will cover emerging technologies for gas heat pump water heating, with a focus on residential applications. Speakers will review market considerations, provide up-to-date lab and field research data, and share a roadmap for accelerated commercialization.

Session 2CBroadway II**Demonstration of Hot Water Systems in Commercial Kitchens for the California Energy Commission**Moderator: **Amin Delagah**, Fisher-Nickel, Inc.

Results from Monitoring the Existing Hot Water System at an Elementary School

Speaker: **Michael Slater**, Fisher-Nickel, Inc.

Results from an In-Depth Hot Water System Replacement Project in a Full-Service Restaurant

Speaker: **Don Fisher**, Fisher Consultants

Results from a Second Generation Hot Water System Testing Laboratory at Pacific Gas & Electric Company (PG&E)

Speaker: **Eddie Huestis**, PG&E Applied Technology Services

Description: Fisher-Nickel Inc. has recently taken on two extensive field projects that seek to modernize hot water system design and operation. The first speaker will summarize the results from monitoring an existing hot water

system in a K-6 school that included point-of-use monitoring in the dish room. The second speaker will discuss a study that monitored a full-service restaurant's hot water use, from generation to point of use, and will detail the design and installation of the optimized system. The third speaker will present existing results from recent testing completed PG&E's second-generation Commercial Hot Water System Laboratory. This lab measures incremental savings from optimization practices by mimicking the operation of hot water systems in full-service restaurants.

Session 2DBroadway III**Unintended Consequences of Energy and Water Efficiency Standards**

Moderator: **Jim Lutz**, Hot Water Research

What Happened to All the Forecasted Large Tank HPWHs after the NAECA 3 Ruling? — How the Supply Chain Did Workarounds to Their Deployment

Speaker: **Geoff Wickes**, Northwest Energy Efficiency Alliance

How Water and Energy-Efficient Building Standards and Designs Can Impact Potable Water Quality

Speaker: **William Rhoads**, Virginia Polytechnic Institute and State University

It's All About the System

Speaker: **Gary Klein**, Gary Klein and Associates

Description: Because domestic hot water delivery is part of a system, changing one part of that system will impact the rest of it. Energy and efficiency standards have targeted only appliances and fixtures so far. This session looks at some of the unintended consequences of those standards on the rest of the system. Differential energy efficiency standards on electric water heaters based on storage volume appear to have caused unintended changes in the sales of large water heaters. Further, water conservation standards are driving down the water flow rates in on-premise plumbing. This is likely to encourage the growth of pathogens in the plumbing and cause operational problems for the water and wastewater utilities.

3:00 – 3:30 pm**NETWORKING BREAK***Plaza Foyer***3:30 – 5:00 pm****BREAKOUT SESSIONS**Session 3APavilion West**Grid-Interactive Water Heating Research and Market Development in the Pacific Northwest**

Moderator: **Steven Koep**, Vaughn Thermal Corporation; Co-Chair, PLMA Behind-the-Meter Storage (BTMS) Interest Group

Developing 'Grid Friendly' Electric Water Heating: Efficient and Controllable

Speaker: **Jennifer McMaster**, Bonneville Power Administration

Standardizing GIWH and Rolling Out at Scale (Design and Implementation of a Utility-Backed CTA2045-Enabled Water Heating Program)

Speaker: **Roch Naleway**, Portland General Electric

Water Heaters for Grid Energy Storage in the Northwest

Speaker: **Ken Dragoon**, Flink Energy

Description: This session will examine research and market development activities in the Pacific Northwest that focus on capturing the value of proliferating GIWH, load management, and HPWH technologies. Hear from organizations and utilities that are working to develop the potential to deploy connected water heaters in consumers' homes.

Session 3BBroadway I**Frontiers in Heat Pump Water Heater (HPWH) Research**Moderator: **Geoff Wickes**, Northwest Energy Efficiency Alliance

Conditioning Interactions with HPWHs: A Test in Side-by-Side Lab Homes

Speaker: **Cheryn Metzger**, Pacific Northwest National Laboratory

Results from a 23-Site Residential Field Study of Hybrid HPWHs in Central California

Speaker: **Owen Howlett**, Sacramento Municipal Utility District

Towards a Universal Test Pattern: Lab Studies of Water Heater Control Responses to Various Draws

Speaker: **Ben Larson**, Ecotope

Description: This session will present the latest research on how HPWHs interact with their environment and how they react to the draws placed on them. From lab studies, to studies in side-by-side lab homes, to real houses, speakers provide cutting-edge work on how water heaters respond to different demand conditions, and discuss their efforts in the field.

Session 3CBroadway II**Solar Thermal Water Heaters**Moderator: **Larry Weingarten**

Solar Powered Water Heating Technology Research

Speaker: **Gerardo Diaz**, University of California, Merced

Ultra-High-Efficiency, PV-System-Integrated, Non-Grid-Tied Hot Water Energy Storage

Speaker: **Carlos Colon**, University of Central Florida, The Florida Solar Energy Center

Assessment of Current and Potential Environmental Benefits of Residential Solar Water Heating in California

Speaker: **Loren Lutzenhiser**, California Energy Commission (*invited*)

Description: Solar thermal is dead! We have probably all heard this, but it is not true. Speakers will bring you up to date on research that demonstrates how direct solar thermal and PV powered thermal are evolving to be competitive with other energy sources, even in the present, uncertain energy landscape.

Session 3DBroadway III**Legionella and Water Safety**Moderator: **Jim Lutz**, Hot Water Research

Effect of Flow Rate on Legionella Levels at the Tap

Speakers: **William Rhoads**, Virginia Polytechnic Institute and State University

Legionnaires' Disease in Flint, Michigan: Lessons Learned

Speaker: **William Rhoads**, Virginia Polytechnic Institute and State University

A Monochloramine Study on the Hot Water System in a Hospital

Speaker: **Janet Stout**, Special Pathogens Laboratory

Description: The bacteria Legionella, which can cause Legionnaire's Disease, has become an increasingly alarming threat to human health and safety in relation to hot water systems. Come learn about the effects of flow rate on breeding Legionella, lessons learned from the water crisis in Flint, and current research on a promising method to disinfect water systems.

5:15 – 6:15 pm **LIGHTNING SESSION** *Pavilion West*

Shameless Commerce: Introducing New Products and Services

Description: In this session, we will deviate from our usual norms and offer anyone a few minutes to present the advantages, features, and availability of their new products and services. This session will be filled with short five-minute presentations. Come hear about market innovations and continue discussing them during the reception.

Companies that have signed up to participate to date include Carina Technologies, CYENER (Beijing) Technology Company, D+R International, EcoDrain, Eemax Tankless Water Heaters, Evolve Technologies, Mosaic Power, Orbital Systems, Rheem, SkyCentrics, Vaughn Thermal, and others!

5:30 – 7:30 pm **RECEPTION** *Pavilion East*

Tuesday, February 28

7:30 am – 4:00 pm **REGISTRATION OPEN** *Plaza Foyer*

8:00 – 9:00 am **CONTINENTAL BREAKFAST** *Pavilion East*

9:00 – 10:30 am **BREAKOUT SESSIONS**

Session 4A *Broadway I*

Efficient Hot Water Control and Delivery

Moderator: **Gary Klein**, Gary Klein and Associates

Introduction to Hot Water Controls and Distribution Losses

Speaker: **Gary Klein**, Gary Klein and Associates

Field Study of an Intelligent, Networked, Retrofittable Water Heater Controller

Speaker: **Ben Schoenbauer**, Center for Energy and the Environment

Developments in Recirc Controls in Dorms and Updates on California Energy Commission Crossover Research

Speaker: **Gabriel Ayala**, Enovative

Hot Water Temperature Maintenance Pilot Study

Speaker: **Shawn Oram**, Ecotope

Description: The primary goal of hot water distribution systems is to deliver hot water quickly and efficiently, with minimal waste. This session will review new hot water controls for water heaters and distribution systems, as well as non-control approaches that aim to solve the fundamental problem of quick, efficient hot water delivery.

Session 4BBroadway II**Understanding Electric Heat Pump Water Heater (HPWH) Energy Use across Climates and Draw Patterns**

Moderator: **Jim Lutz**, Hot Water Research

Towards a Universal Test Pattern: Lab Studies of Water Heater Control Responses to Various Draws

Speaker: **Ben Larson**, Ecotope

Simulated Heat Pump Water Heater (HPWH) Performance in All 50 US States

Speaker: **Pierre Delforge**, Natural Resources Defense Council

HPWH Demand Load Diversification

Speaker: **Carl Hiller**, Davis, California

Description: This session grapples with two important topics: how do we predict when the water heater switches between heating components, and how do we use this capability to simulate heat pump water heater performance in all US climates? Both topics explore the water heater's nonlinear responses to independent variables. The first reports on the results of subjecting heat pump water heaters to various draw patterns in the lab. The second details a modeling study of annual energy use across all 50 states.

Session 4CBroadway III**Advances in Drain Water Heat Recovery (DWHR) Modeling and Technology**

Moderator: **Peter Grant**, Davis Energy Group

Development of Title 24s New DWHR Savings Algorithm

Speakers: **Peter Grant**, Davis Energy Group

Eddie Huestis, Pacific Gas and Electric Company Applied Technology Services

Benefit/Cost Analysis of Residential DWHR for California's Title 24

Speaker: **Bo White**, NegaWatt Consulting

The Advantages of Horizontal DWHR

Speaker: **David Velan**, EcoDrain

Description: Vertical DWHR units are being added to California's Title 24 building code, while horizontal DWHR units are entering the market. Speakers will describe the laboratory testing, algorithm development, and benefit/cost calculations driving code changes, as well as some of the benefits of horizontal units.

Session 4DBroadway IV**Unique Program Approaches in the Market**

Moderator: **Alice Rosenberg**, Consortium for Energy Efficiency

Overview of a National Distributed Products Platform (NDDP) Effort to Promote Heat Pump Water Heaters (HPWHs) Midstream

Speaker: **Howard Merson**, Vermont Energy Investment Corporation (VEIC)

Rural Energy for America Program

Speaker: **John Holman**, United States Department of Agriculture, Rural Development, Oregon

Whole House Approach

Speaker: **Jerry Ryan**, New Jersey Natural Gas

What Co-ops Are Doing

Speaker: **Keith Dennis**, National Rural Electric Cooperative Association (NRECA)

Description: Program leaders will present their unique strategies for overcoming market barriers, and the lessons they have learned so far. We'll hear how VEIC is working with EPA to run a midstream incentive program so distributors can promote HPWHs on a national level. A REAP representative will highlight guaranteed loan financing and grant funding to agricultural producers and rural small businesses so they can purchase or install renewable energy systems or make energy efficiency improvements. We'll learn how New Jersey is able to promote water heaters to customers despite cost effectiveness challenges. And a representative from NRECA will share updates from the co-op perspective.

10:30 – 11:00 am **NETWORKING BREAK** *Plaza Foyer*

11:00 am – 12:30 pm **BREAKOUT SESSIONS**

Session 5A

Broadway I

Grid-Responsive Water Heater Controls (HPWHs and ERWHs)

Moderator: **Sarah Widder**, Pacific Northwest National Laboratory

CTA-2045 Smart Water Heater Field Pilot

Speakers: **Amy Bryan**, Jackson EMC
Tristan de Frondeville, SkyCentrics
Bill Hosken, A.O. Smith

Time-Of-Use Water Heater Optimization

Speaker: **William Burke**, Virtual Peaker

Developments in CEA-2045 and Grid-Responsible HPWH Controls

Speaker: **Teja Kuruganti**, Oak Ridge National Laboratory

Description: This session will explore innovations in water-heater control algorithms that enable responsive control of both HPWHs and traditional electric resistance water heaters (ERWHs). This discussion will include CEA-2045, PNNL's VOLTRON platform, and new control logic approaches.

Session 5B

Broadway II

Gas Heat Pump Water Heating: Design of Advanced Sorption Systems

Moderator: **Ed Vineyard**, Oak Ridge National Laboratory

Theory of Semi-Open Sorption Gas-Fired Heat Pump Systems and Early Experimental Results

Speaker: **Kyle Gluesenkamp**, Oak Ridge National Laboratory

Using the Open Source SorpSim for Simulation of Water Heating Applications

Speaker: **Zhiyao Yang**, Oak Ridge National Laboratory

Commercial Water Heating with Gas Absorption Heat Pumps: Development and Impact of Storage Tank Design

Speaker: **Mike Garrabrant**, Stone Mountain Technologies

Description: This session investigates advanced sorption water heating designs and modeling techniques for improving performance.

Session 5CBroadway III**Multifamily Water Heating Great and Small: From Shower Flow Rates to Large Scale Central Heat Pumps**Moderator: **Ben Larson**, Ecotope

Field Measured Flow Rates of Showerheads

Speaker: **Mike Bailey**, Energy Trust of Oregon

Field Results from Distributed and Central Heat Pump DHWs in Four Apartment Complexes of Zero Net Energy Housing

Speaker: **Sean Armstrong**, Redwood Energy

Central Heat Pump Water Heating Systems: Interplay and Efficiency Implications of Heat Pumps and Circulation Loops

Speaker: **Jon Heller**, Ecotope

Description: This session will present the findings of the latest field research in efficient hot water systems for multifamily buildings. It will cover showerhead flow rates, units served by individual hybrid heat pumps, and design implications of large-scale (10+ ton) central heat pump systems.

Session 5DBroadway IV**Market Madness: Coordinating Supply Chain Players on the Heat Pump Water Heaters (HPWH) Court**Moderator: **Geoff Wickes**, Northwest Energy Efficiency Alliance (NEEA)

Rapid Adoption of Energy-Efficient Products through Midstream Interventions

Speaker: **Howard Merson**, Vermont Energy Investment Corporation (VEIC)

Jump Starting the Installer Contractor Markets with Innovative Approaches

Speaker: **Jill Reynolds**, Northwest Energy Efficiency Alliance (NEEA)

Retail Markets: How to Get Utilities, Original Equipment Manufacturers and Retailers on the Same Page

Speaker: **Jessica Atwater**, CLEAResult

Description: The NEEA, VEIC and CLEAResult have worked for the past eight years to transform the electric water heater market, encouraging adoption of heat pump water heater (HPWH) technology while achieving large energy savings throughout the nation. Speakers will take a coast-to-coast look at slam-dunk approaches to drive HPWH sales and savings.

12:30 – 1:30 pm**LUNCH***Pavilion East***1:30 – 3:00 pm****BREAKOUT SESSIONS**Session 6ABroadway I**Behind the Scenes of Water Heater Numerical Simulations**Moderator: **Ben Larson**, Ecotope

Hydroflouroolefins (HFOs) as Low GWP Refrigerants for Residential Heat Pump Water Heaters

Speaker: **Kashif Nawaz**, Oak Ridge National Laboratory

A Public-Domain, Hardware-Based Modeling and Design Tool for Heat Pump Water Heaters (HPWHs)

Speaker: **Bo Shen**, Oak Ridge National Laboratory

HPWHsim: Under the Hood of a Heat Pump Water Heater Performance and Energy Simulator

Speaker: **Michael Logsdon**, Ecotope

HPWH Modeling Improvements in EnergyPlus and BEopt

Speaker: **Jeff Maguire**, National Renewable Energy Lab

Description: How do you do that, exactly? Come and hear the nitty-gritty details of state-of-the-art simulations on HPWHs. This session provides an in-depth look at how numerical simulations can be used to improve HPWH design using physics-based modeling tools and performance map-based modeling tools, and to predict their energy use and performance impact from a whole building integration perspective using EnergyPlus or BEopt.

Session 6B

Broadway II

Wide-Ranging Applications of CO₂ Heat Pump Water Heaters (HPWHs)

Moderator: **Charlie Stephens**, Northwest Energy Efficiency Alliance

Applications for CO₂ Heat Pump Water Heaters in Multifamily Buildings

Speaker: **Jon Heller**, Ecotope

Exploratory Lab Testing of a Residential-Scale Combined Space and Water Heating CO₂ Heat Pump

Speaker: **Ben Larson**, Ecotope

Early Field Installations of a 3-Ton Combined Space and Water Heating CO₂ Heat Pump

Speaker: **Charlie Stephens**, Northwest Energy Efficiency Alliance

Description: In this session, we will cover lab and field study results of various sizes of CO₂ HPWHs in both residential and multifamily housing. Presentations will cover projects involving 2-3 ton capacity heat pumps intended for residential homes, as well as large 500+ multifamily units using CO₂ water-to-water heat pump equipment to recover heat from a grocery store refrigeration system.

Session 6C

Broadway III

Field Monitoring of Dish Rooms in Large Commercial Kitchens

Moderator: **Don Fisher**, Fisher Consultants

Results from Monitoring Three Best-in-Class Flight Conveyor Dishwashers with Heat Recovery

Speaker: **Michael Slater**, Fisher-Nickel, Inc.

Results from an In-Depth Boiler Room and Dish Room Monitoring Project in an Army Cafeteria

Speaker: **Amin Delagah**, Fisher-Nickel, Inc.

The Next Frontier for Savings: Pre-Rinse Operations in Large Dish Rooms

Speaker: **Amin Delagah**, Fisher-Nickel, Inc.

Cash for Kitchens: The Water-Energy Nexus in Your Favorite Eateries

Speaker: **Stan Mueller**, DNV GL Energy Services USA, Inc.

Description: Fisher-Nickel Inc. recently completed three field projects in large commercial dish rooms. The first speaker will compare the results from monitoring water and energy use of three flight conveyor dishwashers with heat recovery systems. The results will compare the best-in-class technology with previous and existing generation standard heat-recovery technology. The second speaker will discuss the findings of a dish room replacement project in an army cafeteria, which features a change from a steam-fed dishwasher to one in which water is heated mostly with onboard heaters. The results highlight the water and energy savings potential in the dish room as well as the energy savings potential in the boiler room. The third speaker will present findings from pre-rinse operations in five large dish rooms. The final speaker will review the results from a pilot water conservation audit and incentive program, Cash for Kitchens, that yielded water and energy savings in Los Angeles restaurants.

Session 6DBroadway IV**California and Beyond: Policy Pathways and Hot Water**Moderator: **Ed Vineyard**, Oak Ridge National Laboratory

Pathways to Decarbonize Residential Water Heating in California

Speaker: **Shuba Raghavan**, University of California, Berkeley

Opportunities and Hurdles in California: A Policy Framework to Decarbonize Thermal Loads in Buildings

Speakers: **Merrian Borgeson**, Natural Resources Defense Council**Pierre Delforge**, Natural Resources Defense Council

The Role of Natural Gas for Water Heating

Speaker: **Sue Kristjansson**, SoCalGas**3:00 – 3:30 pm****NETWORKING BREAK***Plaza Foyer***3:30 – 5:00 pm****BREAKOUT SESSIONS**Session 7ABroadway I**The Potential of Heat Pump Water Heaters (HPWHs) for Demand Response and Grid Services**Moderator: **Sarah Widder**, Pacific Northwest National Laboratory

Grid-Connected HPWHs: Climatic and Seasonal Effects of Optimal Energy Efficiency and Demand Response Potential

Speaker: **Hemang Nerlekar**, Navigant Consulting

HPWHs and Demand Response

Speaker: **George Gurlaskie**, Duke Energy

Hierarchical Controller Design for Engaging HPWHs to Provide Primary Frequency Regulation

Speaker: **Jacob Hansen**, Pacific Northwest National Laboratory

Description: This session will share new research demonstrating the potential for and feasibility of HPWHs providing demand response and grid services. Electric resistance water heaters have long been explored for providing this functionality, but more efficient HPWHs can provide similar services while saving 50-60% on water heater energy use. These grid-responsive HPWHs have the potential to provide significant benefits to the grid and the consumer. This session will present recent research evaluating HPWHs that provide grid services in the field, and large-scale modeling efforts that evaluate HPWHs ability to serve as “virtual batteries”. It will provide insight from utilities for developing and implementing programs.

Session 7BBroadway II**Cutting Edge Multifamily Research: New Data, Projects, and Programs**Moderator: **Chris Perry**, American Council for an Energy-Efficient Economy

Domestic Hot Water (DHW) Electrification in Multifamily Buildings: An On-the-Ground Perspective

Speakers: **Andy Brooks**, Association for Energy Affordability Inc.**Nick Dirr**, Association for Energy Affordability Inc.

How Much Water Do People Use: New Sources of Water Use Data

Speaker: **Nehemiah Stone**, Stone Energy

Electric Water Heating in Zero Energy Ready Multifamily Buildings

Speaker: **Jess Kincaid**, Bonneville Power Administration

Description: Efficient electric water heating is playing an increasingly important role in reducing the overall electric load of new multifamily buildings. Yet we have lacked sufficient data on hot water use and case studies on implementing efficient hot water projects...until now. Join us to learn about cutting-edge research in the field of multifamily water heating. You will learn about new data that more accurately reflects multifamily hot water use, results from a new Zero Energy Ready multifamily program, and overcoming the challenges of a California DHW electrification project.

Session 7C

Broadway III

New Standards for Hot Water

Moderator: **Danny Tam**, California Energy Commission

How Hot Water Is Calculated in Title 24

Speaker: **Jim Lutz**, Hot Water Research

Hot Water Draw Patterns in Title 24 Calculations

Speaker: **Bruce Wilcox**, Consultant

Reporting on International Association of Plumbing and Mechanical Officials (IAPMO) Pipe Sizing Activities

Speaker: **Dan Cole**, International Association of Plumbing and Mechanical Officials (IAPMO)

Description: The California Energy Commission is updating its Building Energy Efficiency Standards (Title 24) and IAPMO has been researching the best way to size domestic water pipes. The first speaker will examine how hot water energy use is calculated in the building energy efficiency standards. The second speaker will explain recent changes to the hot water draw schedule and heat pump water heater simulations in those standards. The third speaker will report on the recent work of IAPMO's Pipe Sizing Task Force and implications for code changes.

Thank You Funders and Allies!

CO-HOSTS



GOLD



SILVER



BRONZE

