



Hot Water Forum

The Hilton Portland Downtown • Portland, OR • March 20 – 22, 2018

PROGRAM

Tuesday, March 20

4:00 – 7:00 pm Registration

5:30 – 8:00 pm Reception

Wednesday, March 21

7:30 am – 6:00 pm Registration

8:00 – 9:00 am Continental Breakfast

9:00 – 10:30 am Welcome, Introductions, and Plenary Panel

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

Welcome from Co-Hosts: **Joshua Greene**, AO Smith
 Karen Meyers, Rheem Manufacturing

Perspectives on the Potential Opportunities for Connected Water Heating

Moderator: **George M. Chapman**, Consortium for Energy Efficiency

Panelists: **Chuck Thomas**, Electric Power Research Institute
 Aykut Yilmaz, Air-Conditioning, Heating and Refrigeration Institute
 Alice Rosenberg, Consortium for Energy Efficiency

10:30–11:00 am **Networking Break** – *sponsored by AO Smith*

10:45 am – 12:45 pm **Drain Water Heat Recover Training Session** (*advanced registration was required*)
 Training provided by RenewABILITY Energy Ltd.

11:00 am – 12:30 pm Breakout Sessions***Smart, Grid-Connected, and HPWHs Track*****1A. The Connected Future: Policy, Theory, and Infrastructure for Getting to Scale**

Moderators: **Sarah Widder**, Cadeo Group
Alexi Miller, New Buildings Institute

Smart Water Heaters: Carbon Impacts, Grid Impacts, and Market Transformation

Presenter: **Alexi Miller**, New Buildings Institute

Electrification of Domestic Hot Water: Does It Lead to a More Sustainable Future?

Presenter: **Jennifer McWilliams**, DNV GL

Infrastructure Ready Products for Decarbonization

Presenter: **Ram Narayanamurthy**, Electric Power Research Institute

The electricity grid is changing fast. The rise of distributed renewables and net zero energy buildings is driving policymakers, utilities, and others to think beyond baseloads and peakers. The duck has come home to roost. Smart, grid-integrated devices are enabling transformative changes in how buildings interact with the grid. At the same time, the carbon impacts of building energy consumption are a major policy driver in jurisdictions across the country. More than ever, all kWh' are not created equal. The carbon impacts of energy consumption vary by location and time of day. Intelligent, grid-enabled water heaters have an important role to play in the smart, sustainable buildings of tomorrow. New technology enables us to track usage and measure impacts on increasingly granular time scales, whether by hour or by second. This panel will bring together three experts in building-grid interactions, carbon impacts, and market transformation to focus on the policy, technology, and carbon implications of grid-enabled water heaters at granular time scales.

Technologies Track**1B. Verification and Validation of Hot Water System Simulations**

Moderator: **Jennifer Amann**, American Council for an Energy-Efficient Economy

How Domestic Hot Water Is Being Left Out of ASHRAE 90.1

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

Lab Tests to Model Heat Pump Water Heater Controls

Presenter: **Ben Larson**, Ecotope

Verifying Simulation Models of Water Heaters

Presenter: **Jeff Maguire**, National Renewable Energy Laboratory, US Department of Energy

As buildings get more energy efficient, domestic water heating is becoming a significant portion of the energy load. The water heating system components in computer building-energy-simulation tools are not subject to the same level of verification as the rest of the tools. As more of these models are incorporated into building standard codes, how do we know they perform as claimed? There is a technical side of this (how to actually do the verification) and a regulatory side (identifying the standards for doing this verification).

Sectors Track**1C. Large Scale Electric Heat Pump Water Heaters in Multifamily Buildings**

Moderator: **Janice Peterson**, Bonneville Power Administration

Heat Pump Water Heaters Are Not Boilers: Key Differences for Designers

Presenter: **Shawn Oram**, Ecotope

Case Study: Multifamily Affordable Heat Pump Water Heater Installations in Northern California

Presenter: **Nic Dirr**, Association for Energy Affordability

Hydronic Residential Heat Pump Field Results from 61 Daiken Althermas in Zero Net Energy Multifamily Housing

Presenter: **Sean Armstrong**, Redwood Energy

The past decade has seen the emergence and successful deployment of heat pump water heaters at the single-family housing scale. At the same time, the demand for net zero, carbon neutral, and low energy multifamily housing has risen. Electric heat pump water heaters are an obvious fit for those demands but how do they scale up to serve these larger buildings? Presentations will feature answers from three perspectives. The first presentation will examine theoretical and practical differences when designing large-scale heat pump water heater systems compared to traditional gas boilers. The second presentation explores case studies of deploying six central heat pump systems from the perspective of ownership, contractor, financier, and incentive program. The third presentation will outline field results of a large deployment of heat pumps at a California building site.

Policy, Programs and Health Track**1D. Navigating a Sea of Change: How Utilities Are Addressing the Evolving Water Heater Market**

Moderator: **Jake Marin**, Vermont Energy Investment Corporation

A Comprehensive Strategy to Deploy Efficient Water Heaters at Scale

Presenter: **Howard Merson**, Vermont Energy Investment Corporation

Program Collaboration to Drive Market Transformation: CEE Residential Water Heating Initiative

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

The water heating tide has shifted rapidly over a short duration. Key developments include new products entering the market, evolving regulatory goals or portfolio objectives, evolution of load management capabilities, and a new federal testing procedure. The session will provide insight into the strategies and approaches that both gas and electric ratepayer-funded efficiency programs are deploying in order to address these drivers. Presenters will speak about emerging trends, successes to date, lessons learned, and plans to deliver market transformation for residential customers. These efforts will focus on comprehensive water heating program strategies that work across multiple intervention points (midstream/downstream), collaborate with several key stakeholders, and provide new levels of energy savings.

12:30 – 1:30 pm

Networking Lunch and Displays

1:30 – 3:00 pm**Breakout Sessions***Smart, Grid-Connect, and HPWHs Track***2A. Technology Developments: Grid-Connected Heat Pump Water Heaters**Moderator: **Ben Larson**, Ecotope

Lab Testing Heat Pump Water Heaters for Modeling Load Shifting

Presenter: **Peter Grant**, Frontier Energy

Can Heat Pump Water Heaters Teach the California Duck Curve to Fly?

Presenter: **Pierre Delforge**, National Renewable Defense Council

Heat pump water heaters (HPWHs) offer tremendous opportunities for energy efficiency. Research has shown that they also have the potential to provide demand response (DR) benefits. The presenters will discuss the potential of HPWHs for providing thermal storage capability and flexible demand resources to the grid and help balance renewables. The speaker from Frontier Energy will discuss how lab measurements are needed to demonstrate and model the potential for demand response opportunities. The speaker from NRDC will explain how HPWHs contribute to California's energy efficiency and emissions goals while also helping mitigate the duck curve and integrate deep renewables.

*Technologies Track***2B. The Latest in CO₂ Heat Pump Research**Moderator: **Charlie Stephens**, Northwest Energy Efficiency AllianceCO₂ Combi System Compared to Other Systems in the PNNL Lab HomesPresenter: **Cheryn Metzger**, Pacific Northwest National Laboratory

Mitigating the Parasitic Effect of Heat Pump Water Heaters on Home Heating Systems in Cold Climates

Presenter: **Steve Groves**, Fortis BCOptimizing CO₂ Refrigerant Heat Pump PerformancePresenter: **Ken Eklund**, Washington State UniversityLarge Capacity CO₂ Refrigerant Heat PumpsPresenter: **Charlie Stephens**, Northwest Energy Efficiency Alliance

CO₂ air-to-water heat pumps have the potential to provide multiple benefits in space and water heating roles. They have high efficiency ratings and operate at very low outdoor ambient temperatures while producing very hot water. CO₂ air-to-water heat pumps can provide both space and domestic water heating and provide excellent DR and energy storage services using a very low global warming potential (GWP) refrigerant. Current refrigerants are a growing climate change concern. Until the last few years, very little laboratory or field research was conducted. New work provides insight and data on the performance of these systems in the lab and in the field.

Sectors Track**2C. Changes in Residential Hot Water Use and Opportunities for Savings**

Moderators: **Sarah Widder**, Cadeo Group
Bonnie Watson, Bonneville Power Administration

Changes in Residential Hot Water Use and Opportunities for Savings
 Presenters: **Sarah Widder**, Cadeo Group
Bonnie Watson, Bonneville Power Administration

Are There Savings in Lower GPM Showerheads?
 Presenter: **Jim Lutz**, Hot Water Research

How Low Can We Go in Existing Buildings?
 Presenter: **Troy Sherman**, Evolve Technologies

How Long Can We Go on Hot Water Flow Rates and Use in New Buildings?
 Presenter: **Gary Klein**, Gary Klein Associates

The recent *Residential End Uses of Water* study (REUWS 2016) found that residential hot water uses have reduced overall, but some end uses are seeing less change. This session will review overall trends in hot water use, both nationally and regionally, and explore the question, “How low can we go?” in terms of both hot water flow rates and total consumption. Come ready to listen, learn, and participate!

Policy, Programs, and Health Track**2D: Developments in Water Heating Policy and Regulation**

Moderator: **Misty Guard**, Bradley Corporation

Analysis of US Residential Water Heater Stakeholder System and Decision-Making Process
 Presenter: **Anurag Mantha**, Virginia Tech

Water Conservation Out in the Cold: From the IECC to the IPC
 Presenter: **Alexi Miller**, New Buildings Institute

Lessons in Efficiency and Durability from the Past
 Presenter: **Larry Weingarten**, New Buildings Institute

Policies and regulations affect many aspects of the water heating industry. From federal, state, and local regulations, from codes and standards to requirements for residential vs. commercial applications, the water heating industry is experiencing a rapidly changing environment. Speakers will focus on the history of water heating, water conservation in US codes, and the US residential stakeholders and processes.

3:00 – 3:30 pm

Networking Break – sponsored by AO Smith

3:30 – 5:00 pm**Breakout Sessions***Smart, Grid-Connect, and HPWHs Track***3A. The Consumer Experience: Findings from the Field of Connected Pilots**Moderator: **Chris Granda**, Appliance Standards Awareness Project

Benefits from Smart Grid Interactive Water Heaters

Presenter: **Conrad Eustis**, Portland General Electric

Demand Response 2.0: Not Your Father's Water Heater Demand Response Program

Presenter: **Philip Kelsven**, Bonneville Power Administration

Optimizing Grid and Consumer Benefits to Increase Participation

Presenter: **George Gurlaskie**, Duke Energy

Customer interest, awareness, education, and program cost effectiveness remain prevalent barriers to the residential water heater market at large, but how is this playing out with connected “smart” water heaters? This session will provide an opportunity to hear about pilots and programs that leverage advanced water heaters, with a focus on the consumer experience. Many programs are exploring ways to leverage the thermal storage aspect of water heaters to drive system efficiency gains, enable load management, and address behavioral considerations. These efforts aim to deliver benefits to both the homeowner and utility through control that enables peak shaving, daily load shaping, and integration of renewable generation.

*Technologies Track***3B: The Future of Solar Water Heaters**Moderator: **Larry Weingarten**, Consultant

New Efficient Water Heating Technologies: What Does This Mean for Solar Thermal?

Presenter: **Shawn Martin**, Solar Rating and Certification Corporation

Thermal Mass Foundation Heated with Solar Thermal Collectors

Presenter: **Pauline Guntlow**, Brookside Construction

PV Powered Heat Pump DHW in a Hot Humid Climate

Presenter: **Babak Hamzavy**, Southern Research

Numerous new technologies seeking to provide hot water in more sustainable and efficient ways have been entering the market in recent years. Photovoltaics, heat pumps, and tankless water heaters have been maturing and growing in availability. What does this mean for solar thermal, the traditional sustainable water heating solution? Are these potential replacements for solar thermal across the board? Or is solar thermal learning new tricks and finding new applications?

*Sectors Track***3C. Commercial and Industrial Applications of High Efficiency Gas Water Heating I**

Moderator: **Rick Hodges**, Northwest Natural

Gas Heat Pump Water Heating in Commercial Laundries

Presenter: **Michael Garrabrant**, SMTI

Demonstration of Gas Heat Pump Water Heating/ Cooling in Commercial Food Service

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

High-Efficiency, Low-Emissions Combustion for Commercial Hot Water Boilers

Presenters: **Sandeep Alavandi**, Gas Technology Institute

David Cygan, Gas Technology Institute

Often the workhorses of many businesses and institutions, gas water heaters in commercial and industrial applications typically have much higher capacity factors than in residential applications. As a result, end users have a greater appetite for innovation to improve efficiency and environmental impact, such as the greater percentage of “condensing efficiency” equipment and low-NO_x combustion technology. In the first of two sessions, speakers will focus on commercial laundry and restaurant applications, discussing the use of gas heat pump water heating in these two applications in separate efforts, and the development and deployment of a novel burner technology for hot water boilers in a commercial laundry.

*Policy, Programs, and Health Track***3D. Three Perspectives on Net Zero**

Moderator: **Bryce Yonker**, Smart Grid Northwest

The View from Australia

Presenter: **Jon Irwin**, Sustainable Energy Products Australia

The Heat Pump/Organic Rankine Cycle Innovation

Presenter: **Peter Said**, Tryden Energy

How Low Can We Go?

Presenter: **Gary Klein**, Gary Klein Associates

The titles says it all! What changes when we look at hot water systems through the lens of our colleagues Down Under? What about new inventions that run counter to current thinking? Will the water heating system still be safe and satisfying to users?

5:15–6:15 pm

Lightning Session

Shameless Commerce: Introducing New Products and Services

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 rapid two-and-a-half-minute presentations. Come hear about market innovations and continue discussing them during the reception.

Companies participating include Carina Technology, D'MAND Controls®, Fusionthermal Limited, Hays Fluid Controls, Sharc, Shower Steam, Taco Comfort, and Vaughn Thermal Corporation

6:15 – 7:30 pm **Reception**

7:30 – 9:00 pm **Informal Session**

Beneficial Electrification: The Need to Re-focus on Emissions Efficiency

Session Lead: **Steven Koep**, Vaughn Thermal Corporation

Keith Dennis, National Rural Electric Cooperative Association, and Jim Lazar, Regulatory Assistance Project, co-authors of *The Electricity Journal* article titled, “Environmentally Beneficial Electrification–The Dawn of Emissions Efficiency,” and Robin Roy, consultant to the Natural Resources Defense Council, will lead a conversation on the emerging consensus regarding “emissions efficiency” and beneficial electrification, particularly as it relates to the nation’s water heating market.

Join us for an active dialogue about the timely importance of **beneficial electrification!**

Thursday, March 22

7:30 am – 4:00 pm **Registration**

8:00 – 9:00 am **Continental Breakfast**

9:00 – 10:30 am **Breakout Sessions**

Smart, Grid-Connect, and HPWHs Track

4A. Developments in Gas Heat Pump Water Heaters

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

Development and Assessment of Commercial Gas Heat Pump Water Heaters

Presenter: **Michael Garrabrant**, SMTI

Chris Keinath, SMTI

Experimental Results on Gas-Fired Membrane-Based Semi-Open Sorption Water Heaters

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

Preliminary Findings from Next Generation SMTI Residential GHPWH Demonstration

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

With continued pressure to increase operating efficiencies and carbon emission reductions, gas-fired water heating technologies must go “beyond condensing.” In this session, three speakers cover efforts to design, develop, and demonstrate emerging Gas Heat Pump Water Heating (GHPWH) technologies. These include two efforts to bring GHPWHs to residences, with experimental and demonstration results discussed, and another effort to develop a commercial-sized GHPWH.

Technologies Track**4B. Designing Hot Water Distribution, Delivery, and Plumbing Systems**

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

Report on Uniform Plumbing Code Pipe Sizing Activities

Presenter: **Dan Cole**, International Association of Plumbers and Mechanical Officials

Hot Water Distribution System Losses in a Net Zero Home

Presenter: **Tania Ullah**, National Institute of Standards and Technology, US Department of Commerce

A Model of In-Home Water Distribution Systems Energy Losses Using a Civil Engineering Tool for Water Utility Pipelines

Presenter: **Toritseju Omaghomi**, University of Cincinnati

This session looks at hot water distribution, delivery and plumbing systems inside dwellings. A presentation will include a report on how actual domestic water use patterns are leading to changes in the plumbing code. Finally, we will look at monitored and modeled energy losses in hot water distribution systems in single-family homes.

Sectors Track**4C: Field Monitoring of End-Use Fixtures and Equipment in Commercial Kitchens**

Moderator: **Don Fisher**, Fisher Consultants

Results from Monitoring 17 Pre-Rinse Operations in Large Dish Rooms

Presenter: **Amin Delagah**, Frontier Energy, Inc.

Development and Demonstration of a Compressed-Air-Boosted Pre-Rinse Spray Valve (PRSV) Unit

Presenter: **Jesse Castaneda Lutz**, California Polytechnic State University and H. Parker Hospitality

Results from Replacing 10 Cold and Hot Water Dipper Wells in Commercial Kitchens that Show 95% in Energy and Water Savings

Presenter: **Michael Slater**, Frontier Energy, Inc.

The presenters have recently completed projects in commercial kitchens that aim to disrupt business-as-usual operations with relation to various sanitation operations. The first speaker will compare the results from monitoring water and energy use of 17 pre-rinse operations in large dish rooms. Operations such as dry scraping, (PRSVs), scrapers, pulpers, troughs and industrial hoses will be characterized. For comparison of various technologies for their water and energy footprint, the monitored data from various practices or combinations of multiple practices at each site will be normalized by the hours of rinse operation of the conveyor dishwasher. The second speaker will introduce an innovative PRSV that mixes compressed air and water to significantly increase velocity and force of the resultant outlet stream. Developed prototypes have shown a dramatic reduction in water usage (over 66% reduction) while maintaining the force and power characteristics required for effective cleaning. The process mimics the operation of a pressure washer but without raising the system to dangerously high pressures or requiring the “always on” requirement of a water pump. The third speaker will present findings from dipper well replacement projects in 10 facilities including restaurants, ice-cream shops, coffee shops, and juice shops. New technologies on the market have demonstrated a water and energy use reduction for the utensil holding operation of approximately 95% versus dipper wells with increased productivity by staff in some cases. Speakers will highlight the various technologies that have been tested in the field and make the case for rapid market transformation away from dipper wells and toward modern utensil holding products with the support of water and energy utility incentives.

*Policy, Programs and Health Track***4D. Promoting Water Heating through Midstream Programs**

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

Jump Starting Heat Pump Water Heater Sales: ENERGY STAR's® Latest Efforts to Grow the Heat Pump Water Heater Market

Presenter: **Stacy Glatting**, US Environmental Protection Agency

Promoting Heat Pump Water Heaters

Presenter: **Lisa Boba**, The United Illuminating Company

Selling Heat Pump Water Heaters – The Final Frontier

Presenter: **Jill Reynolds**, Northwest Energy Efficiency Alliance

Residential water heating programs are finding increasing value in moving efforts up the supply chain, by promoting efficient products at the midstream level. Presenters will share their work designing and deploying programs designed to incentivize retailers and distributors to stock and promote efficient water heating equipment (both gas and electric products). These include strategies to increase installer, sales associate, and consumer adoption. Speakers will talk about their efforts to date, as well as plans for the future direction of their residential water heating midstream programs.

10:30 – 11:00 am **Networking Break** – *sponsored by the International Code Council*

11:00 am – 12:30 pm **Breakout Sessions**

*Smart, Grid-Connect, and HPWHs Track***5A. Technology Developments: Grid-Connected Controls, Monitoring, and Retrofits**

Moderator: **Steven Koep**, Vaughn Thermal Corporation

Panelists: **Paul Steffes**, Steffes Corporation

Matt Carlson, Aquanta, Inc.

Laurie Vaudreuil, Mosaic Power

Kit Hagen, Nationwide Energy Partners

Grid-Connected Control Providers Roundtable —Grid-connected water heating is emerging as the low-hanging fruit of energy storage technologies. Hear from control providers about the technologies and program models that they are bringing to the energy storage market.

*Technologies Track***5B. Heat Pump Water Heaters and The Last Mile: Installation, Implementation, and Answers to Lingering Questions**

Moderator: **Sarah Widder**, Cadeo Group

Perceptions and Realities of HPWH Market Barriers and Related Best Practices

Presenter: **Josh Butzbaugh**, Pacific Northwest National Laboratory

Characterization of HPWH Interaction with Space Conditioning Systems in the PNNL Lab Homes

Presenters: **Sarah Widder**, Cadeo Group

Cheryn Metzger, Pacific Northwest National Laboratory

Understanding HPWH Interaction with Space Conditioning Systems in the Field

Presenter: **Ben Larson**, Ecotope

Taking it to the Street: HPWHs and Installer Acceptance

Presenter: **Bruce Manclark**, CLEAResult

The technical potential of heat pump water heaters to save significant amounts of energy over conventional electric resistance storage tanks has been well documented by research in the past several years. However questions have remained about how to properly install and operate HPWHs in conditioned spaces that have limited their acceptance by installers and consumers. Specifically, for HPWHs installed within conditioned space, a key lingering question is the impact of the cold exhaust air on the heating system—how much of the energy removed from the air by the HPWH is made up by the heating system? This session will discuss the remaining perceived barriers that stand in the way of widespread market adoption of HPWHs, present the latest research and experience on HPWH interaction factor, address what this means for HPWH installation best practices and energy savings, and provide insights on how to increase acceptance of HPWHs through installers.

*Sectors Track***5C. Advanced Gas Water Heating for Multifamily Buildings: Cutting-Edge Boilers and Heat Pumps**

Moderator: **Holly Braun**, Northwest Natural

New Burner Design Using Additive Manufacturing

Presenter: **Dave Kalensky**, Gas Technology Institute

Breaking through the 100% Efficiency Barrier Using Gas Absorption on Gas Absorption Heat Pumps: A Multifamily Case Study

Presenter: **Ekaterina Tzekova**, The Atmospheric Fund

Updating Our Favorite Conservation Measure: From Condensing Water Heaters to Heat Pumps

Presenter: **Nicole Ceci**, Steven Winter Associates

Gas remains the most prevalent fuel for central water heating systems in multifamily buildings at scale. This session examines three ways to increase the efficiency of gas systems in those buildings. The first presents an advanced burner design concept offering improved efficiency, turndown, emissions, stability, and compactness developed using additive manufacturing. This presentation focuses on the initial design and results of preliminary testing. The second method takes gas system efficiency beyond 100% and explores gas absorption heat pumps as deployed in two multifamily homes in Canada. The talk will present metered results and key findings on design, placement, and commissioning of this emerging technology. The third presentation studies upgrading gas-fired boilers systems in New York City including pre- and post-retrofit utility data. The session will then go beyond the gas boiler to discuss implications for the city's climate plan and why electric heat pumps are being considered for deployment.

*Policy, Programs and Health Track***5D. Legionella and Other Microorganisms**

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

Report on ASHRAE Standard 188 and other Recent Regulations Regarding Legionellosis

Presenter: **Tim Keane**, Legionella Risk Management, Inc.

Working Toward Safer Drinking Water at Home, Work, and School

Presenter: **Tiong Gim Aw**, Tulane University

Flint River Water Switch Increased Propensity of *Legionella Pneumophila* Growth in Premise Plumbing

Presenter: **Rebekah Martin**, Virginia Tech University

World's First On-Site Legionella DNA Test for Buildings

Presenter: **Chris Harder**, Spartan Bioscience Inc.

This session looks at the microbiome in our plumbing. Legionella has been in the news recently. Come hear about recent updates on regulations. Find out what other dangers are lurking in our pipes and what we can do about them.

12:30 – 1:30 pm **Networking Lunch and Displays**

1:30 – 3:00 pm **Breakout Sessions**

*Smart, Grid-Connect, and HPWHs Track***6A. Smart Controls for Efficient Hot Water Generation and Distribution**

Moderator: **Ben Schoenbauer**, Consortium for Energy and Environment

Smart Water Heater Controller—Research Results

Presenter: **Ben Schoenbauer**, Consortium for Energy and Environment

Demand Activated DHW Controls

Presenter: **Larry Acker**, ACT D'MAND Kontrols® Systems

New DHW System Design and Its Real-World Performance Data

Presenters: **Neil Donnelly**, New Ecology, Inc.

How much energy we use in hot water depends not only on the efficiency of the water heater, but also on how efficiently we distribute the water. With millions of existing homes with existing water heaters and existing plumbing systems, simple retrofit solutions are needed to help reduce hot water load when equipment or distribution system replacement is not an option. This session presents several control-based options that serve to increase the hot water system as a whole; delivering savings without expensive retrofit costs.

*Technologies Track***6B. HERS and the WER Index: Capturing Energy and Water Use in Hot Water Systems**

Moderator: **Chris Perry**, American Council for an Energy Efficiency Economy

How Addendum A to ANSI/RESNET/ICC Standard 301 Captures Whole House Hot Water Use

Presenter: **Gary Klein**, Gary Klein Associates

Rating Whole House Water Efficiency through HERSH2O

Presenter: **Jonah Schein**, US Environmental Protection Agency

For the past two years a group of water and energy efficiency professionals have been developing the RESNET Water Efficiency Rating (WER) Index. The group included broad stakeholder participation: raters, builders, suppliers, trades, water utilities, software developers, consultants, and green building programs. Recently, RESNET technical committees completed the final WER Index technical guidelines. These guidelines are largely built on the “Addendum A, Amendment on Domestic Hot Water (DHW) Systems” to the ANSI/RESNET/ICC Standard 301. RESNETs WER Index and its flagship Home Energy Rating System (HERS) Index provide an opportunity to capture whole house energy use related to hot water. This session will look at how the WER Index and HERS Index capture both the water and energy components of hot water use in homes.

*Sectors Track***6C. Commercial and Industrial Applications of High Efficiency Gas Water Heating – Part II**

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

Cool Approaches to Upgrading Central Heating Plant Infrastructure

Presenter: **Brandon Conheim**, DC Sustainable Energy Utility

Design of a Novel Burner for Commercial Water Heating Use Additive Manufacturing

Presenter: **Sandeep Alavandi**, Gas Technology Institute

Case Study of Commercial Near-ZNE Project—Micro-CHP for Pool Heating with Solar PV

Presenter: **Joe Shiau**, Southern California Gas

Often the workhorses of many businesses and institutions, gas water heaters in commercial and industrial applications typically have much higher capacity factors than in residential applications. As a result, end users have a greater appetite for innovation to improve efficiency and environmental impact, such as the greater percentage of “condensing efficiency” equipment and low-NO_x combustion technology. In the second of two sessions, speakers will focus on systems and components, including innovative approaches to upgrade and maintain central plant infrastructure, the potential for additive manufacturing to transform low-emission combustion system designs, and an in-depth case study of integrating on-site renewable energy and Micro-Combined Heat and Power (micro-CHP) for a pool heating application.

Policy, Programs and Health Track**6D. Do We Need Hot Water for Handwashing?**

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

The Room-Temperature Lavatory, Getting Completely Out of Hot Water

Presenter: **Duane Jonlin**, City of Seattle

ICC, IAPMO, EPA, CDC, NSF, ANSI, TJC, APIC, ASHE, CMS, CPSC, VA, ACHD, ASHRAE, and, of course ASSE: Alphabet Soup and Hot Water for Handwashing

Presenter: **Tim Keane**, Legionella Risk Management, Inc.

We all know that washing our hands can keep us from spreading germs and getting sick; however studies have found that cool water removes the same amount of harmful bacteria as hot. So why can't we get it right in the codes?

3:00 – 3:30 pm **Networking Break** – *sponsored by the International Code Council*

3:30 – 5:00 pm **Breakout Sessions**

Smart, Grid-Connect, and HPWHs Track**7A. Technology Developments: Grid-Connected Electric Resistance Water Heaters**

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

Capturing All System Benefits of Grid-Connected Water Heating

Presenter: **Jim Lazar**, Regulatory Assistance Project

The Grid-Enabled Product Category—How We Got Here!

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

Bringing Grid-Connected Water Heaters to Market

Presenter: **Paul Steffes**, Steffes Corporation

Lessons Learned from a CTA2045 Pilot Project

Presenter: **Amy Houston**, Jackson EMC

The Path from Grid-Enabled to Grid Interactive

Presenter: **Steven Koep**, Vaughn Thermal Corporation

Renewed interest in electric water heating, particularly as an integral part of the “connected home” future, is an emerging reality for electric utilities and water heater manufacturers. Join us for a discussion of how grid-connected water heaters and control methodologies interact and evolve as we move from load management and demand response (DR) to DER integration and beneficial electrification.

*Technologies Track***7B. What Are the Best Approaches for the Combi Systems?**

Moderator: **Peter Grant**, Frontier Energy

Optimal Approaches for Water Heating with Combi Systems

Presenter: **Ben Schoenbauer**, Center for Energy and Environment

Optimal Approaches for Space Heating with Combi Systems

Presenter: **Dave Kalensky**, Gas Technology Institute

Optimal Approaches for Tankless Coil Boilers

Presenter: **Thomas Butcher**, Brookhaven National Laboratory

Combined space and water heating applications have a lengthy history in the residential market. But the market share has always remained low. In the past few years, increased activities in standards in regulations in Northern America have increased the availability of equipment and the potential applications. This session will look at the best practices and design approaches for these systems.

*Sectors Track***7C. Final Results from Demonstration of Hot Water Systems in Commercial Kitchens for California Energy Commission**

Moderator: **Amin Delagah**, Frontier Energy, Inc.

Comparative Analysis from Monitoring the Existing and New Hot Water System at an Elementary School

Presenter: **Michael Slater**, Frontier Energy, Inc.

Comparative Analysis from Monitoring the Existing and New Hot Water System in a Full-service Restaurant

Presenter: **Don Fisher**, Fisher Consultants

Final Results and Next Steps from Second Generation Hot Water System Testing Laboratory at Pacific Gas and Electric Company

Presenter: **Eddie Huestis**, Pacific Gas and Electric Applied Technology Services

Frontier Energy Inc. has completed two extensive field projects that seek to modernize hot water system design and operation. The first speaker will summarize the results from monitoring the existing and new hot water system in a K-6 school that included point-of-use monitoring in the dish room. The summary will examine hot water delivery performance, hot water savings, and overall system efficiency in the dish room. The second speaker will discuss a study that monitored hot water use from generation to point of use in a full-service restaurant. Details will be provided on the original and replacement systems' energy and water use, delivery performance and overall system efficiency. Details regarding the design and installation of the optimized system will be covered. The third speaker will present the final results, conclusions, and recommendations from 66 test scenarios completed at the second-generation Commercial Hot Water System Laboratory at PG&E. This lab measured incremental savings from various optimization practices such as a handful of distribution system control strategies, four types of natural gas water heaters, and two types of dishwashers by mimicking the 24-hour operation of hot water systems in full service restaurants.

Policy, Programs and Health Track

7D. Solar Hot Water for a Cooler Climate: Massachusetts Campaigns for the Municipal and Residential Sectors

Moderator: **Alice Rosenberg**, Consortium for Energy and Environment

Overview and Context for the MassCEC Solar Thermal Challenge

Presenter: **Cammy Peterson**, Metropolitan Area Planning Council

Educating and Engaging Multifamily Building Owners and Operators

Presenter: **Marcus Gilmore**, Center for Sustainable Energy

Ways to Increase Uptake of Solar Hot Water Heaters through Targeted Analysis

Presenter: **Jeremey Koo**, Meister Consultants Group

Solar hot water (SHW) technology has been mature for decades, but uptake in the United States has been slow. This has remained the case even with robust state-funded incentive programs in more recent years. Even in cooler climates, SHW systems can offset 70–90% of a buildings hot water use, greatly reducing GHG emissions and costs.

Thank You Funders and Allies!

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