2022 HOT WATER FORUM
VIRTUAL

March 21 – 23

Program

(Presentation times below are ET)

Monday, March 21

12:00 – 1:30 pm (ET) Welcome and Plenary Panel

Welcome and Introductions: **Steve Nadel**, American Council for an Energy-Efficient Economy

Sponsor Welcomes: **Karen Meyers**, Rheem Manufacturing Company
Joshua C. Greene, A.O. Smith Corporation

Plenary Panel: In Hot Water: A Multi-"fauceted" Approach and Divergent Paths to 2050

This session will present thoughtful approaches to how efficient water heating can further decarbonization while creating favorable results for the U.S. economy, workforce, and hot water system as a whole.

Moderator: **George Chapman**, Energy Solutions

Panelists: **Abigail Daken**, U.S. Environmental Protection Agency
Claire Miziolek, Energy Solutions
Michael Sokol, California Energy Commission
Helen Walter-Terrinoni, Air-Conditioning, Heating, & Refrigeration Institute

1:45 – 2:45 pm (ET) Concurrent Sessions

(1A) Gas Solutions

Natural gas is a component of diverse and pragmatic decarbonization solutions. From pairing thermally driven heat pumps with traditional water heating equipment to dual-fuel systems to having a gas utility install electric heat pump water heaters; this session will highlight innovative solutions to the complex issue of using efficient water heating to reduce carbon emissions.

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

Yes, the Gas Utility Is in Hot Water
Presenter: **Richard Donnelly**, Vermont Gas Systems

Playing Nicely Together: Lessons from the Laboratory and Field Pairing Air-to-Water Heat Pumps with Boilers and Commercial Water Heaters
Presenter: **Paul Glanville**, GTI Energy

(1B) Residential Heat Pump Water Heater Market Transformation: Overcoming Cost Hurdles in the Southeast

Learn how a collaboration of industry leaders in the Southeast effectively designed and deployed a unique HPWH program that significantly reduces product and installation costs, trains and retains a dedicated group of installers, and brings this super-efficient water heating technology to a deserving customer base.

Moderator: **Paul Campbell**, ICF

Overview of AWHI's Collaborative Approach to Reducing Heat Pump Water Heater Product and Installation Costs
Presenter: **Owen Howlett**, Advanced Water Heating Initiative (AWHI) Residential Working Group Lead

Marketing Plan and Deployment, Outreach, and Assessment
Presenter: **Nathaniel Jutras**, U.S. Environmental Protection Agency – ENERGY STAR®

From the South: Considerations for Advancing Heat Pump Water Heaters
Presenter: **Maggie Kelley Riggins**, Southeast Energy Efficiency Alliance

Product Application and Training, Bulk Purchasing Channel, and Outreach
Presenter: **Francois Lebrasseur**, A.O. Smith

(1C) Workforce: Contractors

Learn how to engage the "boots on the ground" who have direct contact with the customer. This session will focus on workforce development, leveraging trade allies for successful utility programs to maximize results, and meeting the customer where they are.

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

Market Innovations through Workforce Development Research, Pilots, and Results
Presenter: **Jesse Ander**, Affinity Engineering

Winning the Trade Wars: Recruiting Contractors for Utility Programs
Presenter: **Bruce Manclark**, CLEAResult

Diverse Vendors Help Utilities Deliver Energy Efficiency for All
Presenters: **Angie Ostaszewski**, Ameren Illinois
Carla Walker-Miller, Walker-Miller Energy Services

2:45 – 3:05 pm Q&A and chat rooms on information shared in above sessions

3:15 – 4:15 pm Concurrent Sessions

(2A) Policy and Codes: Aligning Efficiency & Climate Goals

This session will discuss the potential for energy and GHG savings through large-scale decarbonization efforts, which may ultimately be adopted into appropriate building codes and appliance standards. The session will cover research on recirculation pumps, impacts modeling of heat pump water heaters, and solar options for central water heating systems in the recently updated California building code. The session will also discuss how research can result in improved codes and standards, with examples representing different stages of readiness for code adoption. Finally, the session will explore how market transformation efforts inform this code process and examine opportunities for greater connection between efficiency programs and code advocacy.

Moderator: **George Chapman**, Energy Solutions

California's 2022 Building Energy Code: Solar Thermal and Photovoltaics Options for Residential Central Domestic Hot Water Systems
Presenter: **Gina Rodda**, Gabel Energy

Decarbonization of the Residential Fossil Fuel Water Heater Stock Using Heat Pump Water Heater Technologies: This Is Just the Beginning
Presenter: **Christian Valoria**, Pacific Northwest National Laboratory

The Case for On-Demand Domestic Hot Water Recirculation
Presenters: **Pierre Delforge**, Natural Resources Defense Council
Deepak Sivaraman, Energy Solutions

(2B) Hot Water Distribution: Losses and Design

The point of a hot water distribution system is to deliver hot water to the plumbing fixtures and appliances throughout the building with as few losses in water, energy, and time as possible. This session will discuss the magnitude and causes of these losses in design and installation. We will discuss best practices that can minimize these losses and present a metric that can be used to quickly compare the energy efficiency of different distribution alternatives. We will also do a deep dive into the underlying principle of proper pipe sizing and selection for hot water return (as opposed to supply).

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

Hot Water Return Design
Presenter: **Christoph Lohr**, IAPMO

DHW Distribution Heat Loss
Presenter: **Evan Green**, Ecotope

(2C): The New "E's:" A Focus on Emissions and Equity in Market Transformation Programs

This session will focus on emissions and equity issues around water heating, which are the new Es of the E3 Initiative (DOE). The panel will discuss AWHI efforts to expand equitable access to HPWH technology with new outreach in the Midwest, with community-based organizations as effective partners for adoption; panelists will also discuss ENERGY STAR®'s overview of equity in its programs and RMI's assessment of emissions in appliances.

Moderator: **Smita Gupta**, New Buildings Institute

Panelists: **Jim Dennison**, RMI
Maggie Molina, U.S. Environmental Protection Agency
Jacob Serfling, Midwest Building Decarbonization Coalition

4:15 – 4:35 pm Q&A and chat rooms on information shared in above sessions

Tuesday, March 22

12:00 – 1:00 pm Concurrent Sessions

(3A) Equity

The intersection of equity and energy efficiency can help foster a vibrant and equitable economy to reduce energy costs and promote the health, safety, and well-being of all. Hear from three speakers addressing equity and workforce development within water heating. This session will present a virtual tour of commercial heat pump water heaters (HPWHs) in a public housing building and a Native American community center. It will also discuss how to meet a utility program's goals—both for energy savings and equity — by increasing spending with Diverse Business Enterprises (DBE) and reaching disadvantaged communities (DAC) and hard-to-reach (HTR) areas; and a partnership in Bellingham, WA between several non-profits and local government to combine consumer education, incentives, and training through a pilot, "Pump It Up," to promote HPWHs in local homes.

Moderator: **Amber Wood**, American Council for an Energy Efficient Economy

Experience Commercial Heat Pump Water Heaters: On Demand, Interactive Education
Presenter: **Kristy Podelnyk**, D+R International

Building Diversity in a Statewide Midstream Program
Presenter: **Bing Guerin**, DNV Energy Services U.S.A.

Pump It Up: A Residential Heat Pump Water Heater Pilot
Presenter: **Emily Kubiak**, Sustainable Connections

(3B) Gas Heat Pump Water Heaters

In this session, three speakers will cover the emerging Gas Heat Pump Water Heating technology landscape, from program, utility, and technological perspectives. First, GTI will provide an overview of the residential "Combi" gas heat pump landscape, from products to programs. Second, FortisBC will provide a timely update on their significant piloting efforts with Gas heat pump water heaters (HPWHs), covering a range of applications and technologies. Third and finally, HeatAmp will introduce their gas heat pump water heater (HPWH) product development, providing an overview of their novel sorption technology and path-to-market.

Moderator: **Paul Glanville**, GTI Energy

Residential Gas Heat Pump Combis (Space and Water Heating) Landscape or What's with Residential Combi Gas Heat Pumps?
Presenter: **Ryan Kerr**, GTI Energy

From Pilot to Program: Advancing GHP Technologies
Presenters: **Mila Barbour**, FortisBC
James Allen, FortisBC

Towards a Cost-effective Residential Retrofit Gas Heat Pump Water Heater
Presenter: **Magnus Ekblad**, HeatAmp

(3C) Right Sizing Equipment and Piping

The rules for sizing piping were published in the early 1940s. So were the pressure losses in pipes and fittings. ASHRAE updated hot water consumption data before the Energy Policy Act first took effect in the mid-1990s. In short, the codes and standards followed by plumbing system engineers and designers are considerably out of date. In this session, presenters will share how they are designing and installing water heating equipment and hot water distribution system piping based on current flow rates, consumption data and pressure loss data for modern pipes, fittings, and plumbing fixtures.

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

Demand Hot Water — Theory vs Reality
Presenter: **Bob Barrett**, Barrett Consulting

Right Size Water Pipes with Confidence
Presenter: **Peter Skinner**, E2G Solar LLC

Putting Into Practice New WE-Stand Water Sizing on Large Multifamily Projects
Presenter: **Todd Kuchta**, J.W. McClenahan Company

1:00 – 1:20 pm Q&A and chat rooms on information shared in above sessions

1:30 – 2:30 pm Concurrent Sessions

(4A) Moving Markets Together

How are federal, state, and local policies designed to support adoption of HPWHs and address persistent barriers to adoption? What new strategies are under consideration, and which market actors or actions are necessary to realizing these policy objectives? How can we collectively overcome challenges to market transformation? Hear from the Consortium for Energy Efficiency (CEE), ENERGY STAR, and the Advanced Water Heating Initiative (AWHI) about regulatory drivers, common specifications, and program approaches for supporting market transformation across the U.S. and Canada.

Moderator: **Kim Katz**, CEE

Panelists: **Nathaniel Jutras**, U.S. Environmental Protection Agency
Sean Denniston, New Buildings Institute

(4B) Residential 120v Heat Pump Water Heaters: Manufacturers Perspective

In this panel discussion we will hear from manufacturers about where the 120V HPWH fits in the overall water heater landscape, the technical and commercial challenges of this new product, and how to implement policies that will reliably promote this type of product. Early observations from the current California field trial will be shared.

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

Panelists: **Kevin Clark**, Rheem Manufacturing Company
Dan Capelle, GE Appliances
Robert Aldrich, A.O. Smith
Ryan Hamilton, Nyle Water Heating Systems

(4C) Demand Response/Connected: Programs

Grid interactive water heaters are positioned to play a major role in the decarbonization of electricity if operated in a way that does not add additional grid stress during critical times. To support these connected water heater programs, this session will provide realistic estimates of demand response potential for electric resistance water heaters and also lessons learned from existing connected water heater programs from across the U.S.

Moderator: **Christine Riker**, Energy Solutions

Physically Realistic Estimates of Electric Water Heater Demand-Response Resources
Presenter: **Elaine Hale**, NREL

The Key to Winter Peak Demand and Utility Flexibility: Grid-Connected Water Heaters
Presenter: **Drew Scatizzi**, TRC Companies

2:30 – 2:50 pm Q&A and chat rooms on information shared in above sessions

3:00 – 4:00 pm Concurrent Sessions

(5A) Commercial Heat Pump Water Heaters

New heat pump water heater technologies can offer significant energy savings, better control, and lower water usage. However, ensuring the economic viability of these solutions can be challenging because of several interrelated factors, including sizing, designing, modeling, implementing, and operating. This session will discuss strategies that energy efficiency programs can use in their efforts to integrate commercial heat pump water heaters into their portfolios, with the ultimate goal of enabling advanced energy and water savings and societal benefits.

Moderator: **Bouba Dieme**, CEE

Commercial Heat Pump Water Heater Program Design – Guidance and Next Steps
Presenter: **Colleen Collins**, Cadeo

Market Transformation Roadmap for Commercial Heat Pump Water Heating Systems
Presenter: **John Morris**, D+R International

Going Farther, Going Together: Commercial Heat Pump Water Heaters
Presenter: **Bouba Dieme**, CEE

(5B) Multifamily: Case Studies and Design

Heat pumps are poised to transform the market for multifamily water heating. This session will explore where we are in that transformation and present findings and lessons learned from example multifamily projects ranging from low-GWP central systems to distributed clusters of unitary heat pump water heaters (HPWH).

Moderator: **Ben Larson**, Larson Energy Research

Demonstration of Load Shifting in an Affordable Multifamily Clustered Unitary Heat Pump Water Heater Configuration
Presenters: **James Haile**, Frontier Energy
Peter Grant, Lawrence Berkeley National Laboratory

Technology Transformation: Multifamily/Commercial Heat Pump Water Heater Systems
Presenter: **Jonathan Heller**, Ecotope

Large Capacity CO2 Heat Pump Water Heating: Lessons Learned from the Field
Presenter: **Nick Young**, AEA, Inc.

(5C) Demand Response/Connected: Protocols and Controls

This session will explore connected water heaters, including how they work in real life; expected ENERGY STAR® requirements for connectivity; how products will be tested, validated, and listed; and what brand the customer will become familiar with (EcoPort).

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

Findings from Evaluation of the ENERGYSTAR® Test Method to Validate Demand Response for Connected Residential Water Heaters
Presenter: **Don Shirey**, EPRI

Water Heater Control Methods, Demand Reduction, and Energy Impacts in Grid-Interactive Homes
Presenter: **Michael Brambley**, Pacific Northwest National Laboratory

Say Hello to EcoPort: Grid Connected Appliances
Presenters: **Don Dulchinos**, OpenADR Alliance
Tristan deFrondeville, SkyCentrics

4:00 – 4:20 Q&A and chat rooms on information shared in above sessions

4:30 – 5:30 pm Shameless Commerce Lightning Session

Wednesday, March 23

11:00 am – 12:00 pm Plenary Panel: Sustainability and Hot Water Heating Manufacturers: Successes, Challenges, and the Future

Hear from Rheem and A.O. Smith on their sustainability efforts as water heating manufacturers. This session will cover the successes of their current sustainability programs as well as considerations for workforce training and the lack of plumbers. Also learn more about the future plans of these programs such as incorporating wellness and indoor air quality (IAQ).

Moderator: **Mandy Mahoney**, Regulatory Assistance Project

Panelists: **Joshua C. Greene**, A.O. Smith Corporation
Karen Meyers, Rheem Manufacturing Company

12:00 pm – 1:30 pm Pre-recorded Sessions

Take advantage of this time to watch one of the six outstanding pre-recorded sessions listed at the end of this program. These sessions are available in the main menu of the Socio platform.

1:30 – 2:30 pm Concurrent Sessions

(6A) Residential Heat Pump Water Heaters, 120v

Heat pump water heaters have become widely available, yet their space requirements and need for 240v service can limit residential retrofit installations. In this session, learn about emerging retrofit ready, plug-in, 120v heat pump water heaters including market readiness and opportunities. Also hear about retrofit ready technology from a utility and installer perspective. Finally, this session will consider wall-hung units from Europe and present lab test results and applicability to the U.S. market.

Moderator: **Harvey Sachs**, ACEEE

Retrofit Ready Game Changing Technology – The 120v Plug-in Heat Pump Water Heater: Market Opportunities and Technology Readiness Efforts
Presenter: **Amruta Khanolkar**, New Buildings Institute

Retrofit Ready Game Changing Technology: The Utility and Installer Perspective
Presenter: **Peter Florin**, Tech Clean California Incentives

Wall-hung Heat Pump Water Heaters for the U.S. Market
Presenter: **Micah Sweeney**, EPRI

(6B) Commercial Heat Pump Water Heaters: Field Data

Field results will be shared from a 1-year retrofit study in a McDonalds restaurant with a 120-gallon integrated HPWH including valuable insights into system design, sizing, operational issues, performance and water usage characteristics. The second presentation will introduce a skid style plug and play HPWH system built in the factory and deployed in field project in the Northwest and discuss system design, installation, operation, communications, and provide preliminary field performance results, lessons learned and next steps.

Moderator: **Amin Delagah**, TRC Companies, Inc.

Field Evaluation of a 120-gallon Heat Pump Water Heater
Presenter: **Doug Lindsey**, EPRI

The Bayview Tower Project Part 1: A Factory-Built HP Water Heating System in Seattle
Presenters: **Al Takle**, Steffes, LLC
John Bush, OTS Energy

(6C) Water Heaters as a Grid Stability Resource

As renewable energy becomes more common, the need for grid-interactive efficient buildings will increase. This session shares field monitoring experience with two technologies and with implementing smart controls for water heaters in both retrofit and new construction applications.

Moderator: **Peter Grant**, Lawrence Berkeley National Laboratory

Water Heaters as an Energy Efficiency Resource
Presenters: **Matt Carlson**, Aquanta
Zachary Ross, Opinion Dynamics

A Field Study of Grid-connected Heat Pump Water Heaters in the Southeast United States – To Adopt or Not?
Presenter: **Josh Butzbaugh**, Pacific Northwest National Laboratory

2:30 – 2:50 pm Q&A and chat rooms on information shared in above sessions

3:00 – 4:00 pm Concurrent Sessions

(7A) Demand Response/Connected Water Heaters in Multifamily Buildings

This session will feature presentations on the opportunity for grid-connected water heaters in multifamily buildings to provide load flexibility to the grid.

Moderator: **Hannah Bastian**, ACEEE

Load-Shift Opportunities in Multifamily Demand Hot Water Systems
Presenter: **Mark Frankel**, Ecotope

Demand Hot Water Load Shifting Opportunities Using Heat Pump Water Heaters
Presenter: **Ryan Green**, Nyle Water Heating

Mass Deployment at Scale of Grid Connected Water Heaters in Multifamily
Presenter: **Tristan deFrondeville**, SkyCentrics

(7B) Residential Heat Pump Water Heaters: Case Studies

The first presentation reports on a 15-home demonstration pilot that installed HPWHs in manufactured homes, including insights into venting and ducting techniques in tight spaces, differences in HUD and site built plumbing codes, cost and material accounting, and customer satisfaction. The second and third presentations will share field monitoring results on the performance of HPWHs in roughly a dozen homes in the South and Midwest, including valuable insights into the benefits of adding MERV filtration versus OEM, ambient conditions and noise levels in a few locations in the South, and the cost, emissions, space heating, and comfort impacts of HPWHs in the Midwest's cold climate from field data and a survey of 80 rebate participants.

Moderator: **Amin Delagah**, TRC Companies, Inc.

Heat Pump Water Heater In-Situ Performance
Presenters: **Allison A. Bailes III**, Energy Vanguard
Ben Knopp, Community Housing Partners

Installing Heat Pump Water Heaters in Manufactured Homes
Presenter: **Bruce Manclark**, CLEAResult

Heat Pump Water Heaters in the Midwest: Cost, Comfort, and Climate Impacts
Presenter: **Kevin Gries**, Slipstream

(7C) Control Strategies for Pathogens in Water Heaters and Plumbing Systems and Their Unintended Consequences

This session will discuss design and operational considerations for controlling Opportunistic Plumbing Pathogens (OPPs) in building water systems. Additionally, speakers will cover energy and other water quality implications of employing such strategies.

Moderator: **Tania Ullah**, NIST

Collateral Heating, Opportunistic Pathogen Growth Potential, and Energy Losses in Plumbing Systems
Presenter: **Tim Bartrand**, ESPRI

Disinfection By-Product Behavior in Simulated Residential Hot Water Systems
Presenter: **Marylia Duarte Batista**, NIST

Plumbing System Design and Legionella
Presenter: **Tim Keane**, Legionella Risk Management

4:00 – 4:20 pm Q&A and chat rooms on information shared in above sessions

Pre-recorded Sessions Available On-Demand

Lab and Simulated Performance of Heat Pump Water Heaters with Thermal Storage: UEF and First Hour Results

One way to enhance performance of heat pump water heaters is through adding thermal storage. This session will detail the increases in performance of a heat pump water heater wrapped with phase change material capsules and added inside a 6-gallon secondary tank. In addition, learn about the behavior of a new heat pump water heater technology integrating embedded phase change material as part of a co-simulation platform that maximizes performance parameters through comparison of simulations with lab test results.

Moderator: **Harvey Sachs**, ACEEE

First Hour Rating Improvements to a Wrapped Heat Pump Water Heater with Embedded Thermal Energy Storage
Presenter: **Joseph Rendall**, Oak Ridge National Laboratory

Model-based Co-simulation of Heat Pump Water Heater with Embedded Phase Change Materials Thermal Energy Storage
Presenter: **Jian Sun**, Oak Ridge National Laboratory

Demand Response/Connected Heat Pump Water Heaters: Customer Acquisition

Customer acquisition for heat pump water heater (HPWH) load shift programs is key to realizing the major role HPWHs are positioned to play in the decarbonization of electricity. This panel discussion will highlight three separate efforts that are targeting a unique hurdle to optimize when HPWHs are heating water throughout the day. Customer acquisition for load-shifting or demand response programs can be one of the biggest barriers to participation, these projects are testing different ways to increase customer participation in demand response by either harnessing the water heater supply chain, driving compliance with building energy codes, or streamlining the demand response enrollment process.

Moderator: **Nick Dirr**, Association for Energy Affordability

TECH Clean California: Market Readiness for a Heat Pump Water Heater Load Shifting Pilot
Presenter: **Emily Kehmeier**, Energy Solutions

Pacific Gas & Electric WatterSaver
Presenter: **Helen Liu**, Pacific Gas and Electric

Pacific Gas & Electric Midstream Heat Pump Water Heater Study and Field Test
Presenters: **Christine Riker**, Energy Solutions
Andy Doeschot, Pacific Gas and Electric

Solar Thermal & PV Water Heating

From small scale, practical, solar thermal — to large-scale residential and commercial thermal and PV/heat pump systems, we'll discuss novel installation, design, and management practices. We'll cover a range of ways the sun can keep you in hot water!

Moderator: **Larry Weingarten**, Self-Employed

Solar Thermal & PV-thermal Systems for Commercial Hot Water Loads with O&M Management Tools
Presenter: **Henry Vandermark**, Solar Wave Energy

Large Capacity Residential PV-Assisted Heat Pump Water Heater Performance in Florida
Presenter: **Carlos Colon**, FSEC Energy Center

Affordable, Efficient & Durable Solar Demand Hot Water — What's Not to Like?
Presenter: **Zachery Vetter**, Self-Employed

Heat Exchanger Components

This session explores key heat exchanger components in heat pump water heaters and gas fired water heaters through simulation and experimental approaches. Specifically, speakers will discuss a tool for designing heat exchangers utilizing small diameter (5 mm) copper tubes and low-GWP refrigerant, a CFD-based approach to predicting the heat transfer and pressure drop within the flue of gas fired water heaters, and a passive backflush system to prevent fouling of heat exchangers in heat pump water heaters.

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

Simulations Demonstrate the Advantages of Smaller Diameter Copper Tubes in Hot Water Heat Pumps
Presenter: **Yoram Shabtay**, Heat Transfer Technologies

A Novel 3D and 1D CFD Approach to Modeling Gas Fired Water Heaters
Presenter: **Gautham Ramchandran**, Gamma Technologies

Maintaining the Performance of Heat Pump Water Heater with Passive BackFlush Technology (PBF)
Presenter: **Stephen Harrison**, QSBR Innovations and NEOPERL

U.S. Department of Energy: Water Heating Goals, Decarbonization & Regulatory Actions

This session will frame the U. S. Department of Energy's water heating goals and discuss their importance to decarbonization, including the benefits of load-shifting. DOE will also give an update on regulatory actions and discuss research and development priorities in this space.

Moderator: **Amber Wood**, American Council for an Energy-Efficient Economy

Presenters: **John Cymbalsky**, U.S. Department of Energy
Julia Hegarty, U.S. Department of Energy
Ramachandran Narayanamurthy, U.S. Department of Energy

What is Wrong with this Picture?

The real world of hot water throws some interesting curveballs. We will demonstrate some examples and how we dealt with them. What lessons can be learned that apply to new installations.

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

Panelists: **Gary Klein**, Gary Klein and Associates
Larry Weingarten, Self-employed