

2024 HOT AIR & HOT WATER FORUMS

Hot Air Forum | March 12–13
Hot Water Forum | March 13–14

Tuesday, March 12 – Hot Air Forum

7:00 am–7:00 pm	Registration	201 Reg
8:00–9:00 am	Breakfast	Salon West
9:00–10:30 am	Welcome and Plenary	Salon East

Welcome and Introductions

Presenter: **Steve Nadel**, American Council for an Energy-Efficient Economy

Sponsor Welcome and Moderator

Presenter: **Karen Meyers**, Vice President, Government Affairs, Rheem Manufacturing Company

The Home Energy Rebate Program and Other New Federal Programs Affecting Space Heating and Hot Water

We will discuss the Home Energy Rebate program, which will start in 2024 and ultimately provide about \$9 billion for residential energy efficiency and electrification upgrades. We will also discuss a few other new federal programs, such as for state and local building codes and performance standards targeting zero emissions and expanding heat pump production in the U.S.

Presenters: **Kathleen Hogan**, Principal Deputy Under Secretary for Infrastructure, U.S. Department of Energy

Kristofor Anderson, Director of Energy Resources, Georgia Environmental Finance Authority

10:30–11:00 am	Networking Break	Salon – prefunction South
11:00 am–12:30 pm	Concurrent Sessions	

1A: Residential Heating Case Studies Room 203

As heat pump market adoption accelerates and heat pump technology continues to evolve, real world data supporting “house as a system” thinking will be vital to ensure we are getting the performance we hope for. The session presenters will explore the intersection of heat pump and whole building performance using real world field data.

Moderator: **Courtney Moriarta**, NYSERDA

What’s Happening? Lessons Learned from Heat Pump Field Research

Presenter: **Samuel Rosenberg**, Pacific Northwest National Laboratory

Field Evaluation of Variable Speed Heat Pumps for AC Replacement

Presenter: **Ben Schoenbauer**, Center for Energy and Environment (MNCEE)

Heat Pump Ready Manufactured Homes

Presenter: **Christopher Dymond**, Northwest Energy Efficiency Alliance

1B: Market Transformation Programs for Heating

Room 204

This session will consider risks, barriers, and opportunities for heat pump adoption, with an emphasis on high costs for heat pumps and their heating operation relative to gas heat. Presentations will examine the issue of cost from multiple angles, including energy burden, program incentive design, utility rate design, dual fuel heating systems, and underlying drivers of high costs. Speakers will present actions individual programs or utilities could take, as well as a collective approach that coordinates actions across a 13-state region.

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

At What Cost? A Study of the Real Costs of Whole Home and Heating, Ventilation, and Air Conditioning (HVAC) Electrification in the Midwest

Presenter: **Pauravi Shah**, Commonwealth Edison

Not at This Rate: Why Enhanced Rate Structures Are Both Justified and Necessary for Hybrid Air Source Heat Pumps (ASHPs) in the Midwest

Presenter: **Ranal Tudawe**, Center for Energy and Environment (MNCEE)

How to Increase the Demand for Heat Pumps: An Online Trial Examining Household Incentives

Presenter: **Anna Keleher**, Behavioral Insights Team/Nesta

Meeting in the Middle: How the Midwest Is Meeting States Where They Are to Accelerate Air Source Heat Pump (ASHP) Adoption

Presenter: **Joe Ricchiuto**, Midwest Energy Efficiency Alliance

1C: Systems: Rooftop Units

Room 206

Moderator: **Jason Jones**, Northwest Energy Efficiency Alliance

Heat Pump Rooftop Units: Underutilized Decarbonization Strategy for Low-Rise Commercial Buildings

Presenter: **Rachel Lebedinsky**, Guidehouse

Installed Performance of Heat Pump Rooftop Units in Cold Climates

Presenter: **Alex Haynor**, Center for Energy and Environment (MNCEE)

No Really... Rooftop Unit (RTU) Gas Efficiency Is a Decarbonization Strategy

Presenter: **Chris Wolgamott**, Northwest Energy Efficiency Alliance

1D: Design: Sizing Heat Pumps for Heating

Room 207

Air-source heat pumps with "cold climate" or low-temperature capabilities have expanded the market potential for heat pumps to all corners of the continent. While the technology is now readily available, design and installation practices necessary to deliver maximum comfort and performance have been slower to gain traction. This panel will present a series of new tools and resources aimed at supporting improved sizing and installation practices for heat pumps.

Moderator: **Dave Lis**, Northeast Energy Efficiency Partnerships

Heat Pump Quality Installation Tool Pilots and Feedback

Presenter: **Edward Louie**, Pacific Northwest National Laboratory

Manual "J" or Another Way

Presenter: **Brittany Farrell**, Clean Power Research LLC

Advanced Equipment Selection Tools for Cold-Climate Air Source Heat Pumps

Presenter: **Greg Thomas**, Performance Systems Development

Better Together: Cold-Climate Heat Pump Decision Tool & Heat Pump List

Presenter: **Alek Parsons**, Pacific Northwest National Laboratory

12:30–1:30 pm

Networking Lunch

Salon West

1:30–3:00 pm

Concurrent Sessions

2A: Multifamily Non-Traditional Heating in New York

Room 203

Multifamily buildings present a unique set of challenges when making the transition from fossil fuel heating to heat pumps. Attendees will learn about an innovative pilot project to develop and commercialize a new category of heat pump equipment aimed at solving some of New York City's most confounding challenges in decarbonizing affordable multifamily housing.

Moderator: **Courtney Moriarta**, NYSERDA

Packaged Window Heat Pump Product Overview

Presenters: **Jason Wexler**, Gradient
David Leezer, Midea

Technical Challenges and M&V Approaches for Packaged Window Heat Pump Installations

Presenter: **George Aiken**, Taitem Engineering

2B: Performance In Heating Systems

Room 204

Heat pump space conditioning can be the most efficient heating option available—but what makes one heat pump truly perform better than another? This session will explore three studies that dive deep into the metrics, operating conditions, and design-parameters that lead to top-tier heat pump efficiency performance.

Moderator: **Matt Christie**, TRC Companies

Heat Pump Field Operations: Research and Case Studies Demonstrating Enhanced Energy Efficiency from Variable Speed Models

Presenter: **Jonathan Moscatello**, Daikin Comfort Technologies

Exploring the Representativeness of Heat Pump Performance Ratings

Presenter: **David Lis**, Northeast Energy Efficiency Partnerships

Low-Load Efficiency: What Makes Some Heat Pumps Excel in Dual Fuel or Mild Climate Applications

Presenter: **Cory Luker**, Cadeo Group

2C: Systems: Thermal Energy Storage in Heating

Room 206

Large-scale energy storage will be important for decarbonization, especially to mitigate increases in winter peak demand with electrification of space heating. Thermal storage in heating systems has potential to become a key solution addressing these storage needs. This session will explore technologies that can shift electric demand by storing thermal energy integrated with HVAC and with building materials.

Moderator: **Xiaobing Liu**, Oak Ridge National Laboratory

Can Thermal Storage with Heat Pumps Be the Lowest-Cost National-Scale Storage Solution?

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

Electrifying Heat with Storage Source Heat Pumps

Presenter: **Mike Filler**, Trane Technologies

Performance of Advanced Hot Water/Ice Slurry Thermal Energy Storage for Heating and Cooling

Presenter: **Levon Atoyan**, Shift Thermal

Field Evaluation of Dual Temperature Phase Change Material Ceiling Blankets

Presenter: **Ram Dharmarajan**, GTI Energy

2D: Innovation Beyond Heat Pumps and Efficiency

Room 207

The next frontier of HVAC efficiency is ensuring advanced systems are delivering the savings and comfort we have been counting on. Join this panel to learn where to find some of these exclusive but achievable benefits of taking HVAC innovation further.

Moderator: **Suzi Asmus**, Northwest Energy Efficiency Alliance

Unlocking Grid and Customer Benefits of Electrification through Duct Sealing

Presenter: **Joel Summerfield**, AeroSeal

How to Make the Latest Heat Pumps Work with Any Existing Heating, Ventilation, and Air Conditioning (HVAC)

Presenter: **Barend Dronkers**, E Source

Com-mission Impossible? A Rare Opportunity to Transform Heating, Ventilation, and Air Conditioning (HVAC) Practices

Presenter: **Christian Valoria**, Pacific Northwest National Laboratory

Maximizing Heat Recovery in Dedicated Outdoor Air Systems (DOAS): Best Practices for Energy Modeling of High-Efficiency Systems

Presenter: **Neil Bulger**, A2 Efficiency

3:00–3:30 pm

Networking Break

Salon – prefunction South

3:30–5:00 pm

Concurrent Sessions

3A: Smart Grid & Heating

Room 203

We'll explore how heat pumps fit into a future driven by electrification, decarbonization, and an increasing need for load flexibility. Presentations will cover solutions to enhance load shifting and peak reduction, such as ground source heat pumps and controls, and advanced load-forecasting practices.

Moderator: **Christopher Dymond**, Northwest Energy Efficiency Alliance

Buildings and Beyond: How Modernizing Load Forecasting Practices Can Help Utilities Prepare Their Systems for Electrification

Presenter: **Amara Slaymaker**, Dunsky Energy + Climate Advisors

Understanding the Flexible Use of Heat Pumps in Homes: How "Pre-heating" Homes Works in Practice

Presenter: **Anna Keleher**, Behavioral Insights Team/Nesta

Balancing Act: Addressing the Gap Between Ground Source Heat Pump (GSHP) Costs to Customers and Benefits to Utilities

Presenter: **Stephanie Breton**, Dunsky Energy + Climate Advisors

3B: Policy: Emerging Policies to Drive Building Decarbonization

Room 204

This session will explore how state policies can drive the heat pump market while supporting customers and market actors. Panelists will provide an overview of cutting-edge policies like clean heat standards and zero-emission equipment standards, discuss how policies can be designed and coordinated to be equitable and market-friendly, and highlight state efforts to advance these policies.

Moderator: **Matt Casale**, Building Decarbonization Coalition

Zero-Emission Equipment Standards

Presenter: **Nancy L. Seidman**, Regulatory Assistance Project

Clean Heat Standards

Presenter: **Richard Cowart**, Regulatory Assistance Project

Building Decarbonization Policy Options

Presenter: **Erin Cosgrove**, Northeast Energy Efficiency Partnerships

Additional Panelists:

Leah Louis-Prescott, RMI

Emily Levin, NESCAUM

Panel discussion with topics including:

- *How do equipment standards and clean heat standards (CHS) fit together? Are both policies needed?*
- *How to design these policies to be equitable*
- *How to design these policies in ways that work for the market*
- *Which states are adopting these policies and what trends are we seeing*

3C: Systems: Variable Refrigerant Flow (VRF)

Room 206

Variable refrigerant flow (VRF) systems are relatively mature technology and have the capability to provide high-efficiency heating and cooling to multi-zonal buildings across a broad range of ambient conditions. This session will cover field validated performance data from multiple electric VRF demonstrations in cold climates. It will also address VRF system operability, refrigerant considerations, and commissioning best practices as seen in the field.

Moderator: **Ram Dharmarajan**, GTI Energy

Variable Refrigerant Flow (VRF) Performance in New Multifamily Homes in New York City

Presenter: **Kevin McDonald**, Steven Winter Associates

Cold-Climate Variable Refrigerant Flow (VRF): Does It Work and Reduce Emissions in the Upper Midwest

Presenter: **Kevin Frost**, Slipstream

Validating Variable Refrigerant Flow (VRF) in Cold Climates

Presenter: **David Korn**, Ridgeline Analytics

3D: Workforce: Best Practices for Heating

Room 207

HVAC efficiency and user satisfaction ultimately rely on the human factor, frustratingly trickier anything we can measure in a lab test setting. This session will focus on tools, resources, and case studies for training the workforce we need in an evolving HVAC landscape.

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

Don't Stop Believing! The Journey of Developing a Statewide Contractor Network

Presenter: **Rabi Vandergon**, Center for Energy and Environment (MNCEE)

Empowering HVAC Distributors and Contractors: Lessons Learned from An Air-Source Heat Pump Training and Education Pilot

Presenter: **Dan Wildenhaus**, Center for Energy and Environment (MNCEE)

Listen First! Strategies to Create Partnership Cycles in Growing the Next Generation of Heat Pump Workforce

Presenter: **Zachery Paine**, Slipstream

Lessons Learned from Upskilling the Heating, Ventilation and Air Conditioning (HVAC) Workforce

Presenter: **Jamie Kono**, Pacific Northwest National Laboratory

5:30–7:00 pm

Reception

Courtyard North

Wednesday, March 13 – Hot Air & Hot Water Forum Combo Day

7:30 am – 6:00 pm **Registration** **201 Reg**

8:00–9:00 am **Breakfast** **Salon West**

9:00–10:30 am **Plenary Panel** **Salon East**

Transforming Markets for Space and Water Heating

The widespread use of heat pump technology for space and water heating will be necessary for decarbonization. This panel will provide a variety of perspectives on how, and what, will be necessary to make this transformation happen through a mix of creative marketing, program, and policy efforts. The panel will feature perspectives from different segments of the market chain and from different regions.

Sponsor Welcome

Presenter: **Edwin Reek**, Director, Advanced Products Commercialization, Daikin Comfort Technologies North America, Inc.

Sponsor Welcome, Introductions, and Moderator

Presenter: **Josh C. Greene**, Vice President of Government, Regulatory, and Industry Affairs, A.O. Smith Corporation

The Manufacturer's Perspective

Presenter: **Josh C. Greene**, A.O. Smith

The Contractor's Perspective

Presenter: **Ben Foster**, Barnett Plumbing

The Distributor's Perspective

Presenter: **Stephanie Ziegler**, Ferguson

Affordable Multifamily Buildings

Presenter: **Bill Lyons**, Elevate Energy

Focus on Rates and on Programs and Policies in Other States

Presenter: **Steve Nadel**, American Council for an Energy-Efficient Economy

10:30–11:00 am **Networking Break** **Salon – prefunction South**

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

4A: Workforce for Water & Air **Room 203**

Moderator: **Daniel Lawlor**, U.S. Environmental Protection Agency

Using AI to Solve the Clean Heating Labor Shortage

Presenter: **Herbert Dwyer**, EMPEQ

Energy Skilled: U.S. DOE's Energy Efficient Buildings Workforce Training Recognition Program

Presenter: **Charles Degan**, Pacific Northwest National Laboratory

Heat Pump Retrofits: Don't Forget the Envelope

Presenter: **Eduardo Rodriguez-Feo Bermudez**, Pacific Northwest National Laboratory

Powering Progress: Best Practices and Strategic Approaches in Energy Workforce Development

Presenter: **Kendra Lee**, The JPI Group

Leveraging Industry Input to Create Sustainable Solutions

Presenter: **Peter Florin**, Energy Solutions

4B: Systems: Gas, Dual, and Hybrid Heat Pumps

Room 204

Gas systems may be the solution for some customers across the country due to climate, economic, or other factors. This session will highlight the developments of dual-fuel systems and gas heat pumps toward decarbonization and cost savings.

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

Accelerating Next Generation Decarbonization Solutions: Gas Heat Pump Case Study

Presenter: **Randy Opdyke**, Nicor Gas

Debunking the Myths of Hybrid Heat Pumps

Presenter: **Jared Landsman**, E3

Hybrid Dual-Fuel System Control Optimization for Annual Operating Cost and Emission

Presenter: **Navin Kumar**, GTI Energy

Energy Modeling and Analysis of Dual-Fuel Heating Systems in Single-Family Homes

Presenters: **Saurabh Shekhar**, ICF

Nicholas Fette, Lincus

4C: Residential Water Heating Case Studies

Room 206

Efficiency program managers share their experiences and lessons learned from designing and implementing residential heat pump water heater incentive programs.

Moderator: **Kim Katz**, C+C

Heat Pump Water Heaters: Taking the Emergency Out of Emergency Water Heater Replacements

Presenter: **Chris Badger**, VEIC

Pre and Post Installation of Heat Pump Water Heaters: Cal Center for Best Practices and Post Installation Consumer Instruction

Presenter: **Joseph Wachunas**, New Buildings Institute

Residential Heater Program Design: Meeting the Needs of Customer, Contractor, and Utilities

Presenters: **Jordan Losiak**, ComEd

Andy Poffinbarger, ClearResult

4D: Central Heat Pump Water Heater Workshop – A Unified Approach to Accelerated Market Adoption

Room 207

Central Heat Pump Water Heater (HPWH) workshop where we aim to bring together industry experts and manufacturers to create a robust and reliable market for HPWHs. In this workshop, you'll gain insights into market analysis and barriers, learn about the latest technology developments and policies, and explore case studies showcasing the effectiveness of HPWH systems in different climates and conditions. Don't miss this opportunity to dive into the world of central water heating and contribute to a sustainable future.

Moderator: **Keshmira McVey**, Bonneville Power Administration

Panelists: **Noah Gabriel**, New Buildings Institute - Advanced Water Heating Initiative

Scott Spielman, Ecotope

Colleen Collins, Cadeo Group

Andy Brooks, Association for Energy Affordability

12:30–1:30 pm

Lunch & Keynote

Salon West

Ensuring Equity in Household Weatherization and Electrification

The Honorable Stacey Abrams, senior counsel for Rewiring America, former gubernatorial candidate, and former minority leader of the Georgia House of Representatives will be our keynote speaker.

Weatherization and electrification are key to decarbonizing buildings, and will lower bills and improve health, safety, and comfort. But we must ensure low-income and disadvantaged communities are part of the clean energy transition.

Welcome and Introductions

Presenter: **Steve Nadel**, American Council for an Energy-Efficient Economy

Keynote Presenter: **Stacey Abrams**, Senior Counsel, Rewiring America

1:30–3:00 pm

Concurrent Sessions

5A: Policy Updates and Market Preparedness for Heat Pump Deployment

Room 203

Presentations in this session will continue in session 6A, from 3:30 to 5:00 pm in the same room.

Policies at the state and federal levels can help transform the heat pump adoption market. However, policy alone cannot result in transformation. Manufacturers, consumers, and installers need sufficient tools and resources to understand these policies and help achieve their objectives through the increased uptake of efficient heat pump technologies. This session, along with session 6A, will seek to demonstrate the bridge between policy and transformation. This session will focus on important federal policies, including water heater performance standards and IRA funding opportunities, and begin to explore the challenges and opportunities for transformation in the market with real-world examples of consumer and market acceptance and comfort with these products. Attendees are encouraged to participate in session 6A to continue these conversations.

Moderator: **George Chapman**, Energy Solutions

New Federal and State Water Heater Standards and Their Expected Effects

Presenter: **Chris Granda**, Energy Solutions

Improving Equity through Federal Water Heater Standards

Presenter: **Kanchan Swaroop**, Appliance Standards Awareness Project

A Good Start, but Not Nearly Enough: Evaluating IRA Incentives and Complementary Policies for Heat Pump Adoption

Presenter: **Matt Malinowski**, CLASP

Using Customer Experience Data to Optimize Heat Pump Programs

Presenter: **Ellen Steiner**, Opinion Dynamics

The Roadmap to Scale: Using Meter-Based Analysis of Heat Pump Installations to Inform the Next 20 Million Projects

Presenter: **Dylan Sarkisian**, Energy Solutions

5B: Systems: Refrigerants**Room 204**

Moderator: **Holly Tapani**, U.S. Environmental Protection Agency

Design for Decarbonization: Matching Load Profiles to Equipment Selection so We Can Drive a Whole Life Carbon and Grid Interactive Euphoria

Presenter: **Stet Sanborn**, SmithGroup

Next Generation Refrigerants for Water-Heating and Space-Heating Applications

Presenter: **Samuel Yana Motta**, Oak Ridge National Laboratory

Deployment of Propane as Refrigerant for Heat Pump Water Heaters

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

Missed Opportunities: Reducing Green House Gas Emissions from Heat Pump Retrofits

Presenters: **Rachel Murray**, DNV- Energy Systems

Lei Xu, DNV – Energy Services

Cool Refrigerant Developments for a Warming World: Low Global Warming Potential Heat, Ventilation, and Air Conditioning (GWP HVAC) Refrigerant Regulations and Technologies in the U.S. and Global Markets

Presenter: **Jim Young**, Guidehouse

5C: Commercial Water Heating Case Studies**Room 206**

The heating of potable water for showers, cooking and cleaning is the second-largest demand for energy in buildings where we eat and bathe. Meanwhile, hot water service remains one of the most difficult amenities to address in both new construction and upgrades. Field studies and research are driving innovation, and super-efficient systems are now available. Attendees of this session will receive a cross-sectional demonstration of the problem with inefficient systems, and explore strategies to fractionalize the energy needed to provide the expected service.

Moderator: **Ryan Hamilton**, CEE

Optimizing Hot Water Systems in Commercial Facilities: Behavioral Insights from Shower Hot Water Consumption

Presenter: **Priya Thomas**, Shower Stream

Simple Solutions for Complex Problems: Commercial Unitary Heat Pump Water Heaters

Presenter: **Colleen Collins**, Cadeo Group

Reducing Water and Energy Consumption of Domestic Hot Water Systems by Addressing End-Users

Presenter: **Rebecca Hall**, University of Queensland, Australia

5D: Systems: Field Evaluation of Air-to-Water Combination Heat Pumps in Residential and Commercial Buildings**Room 207**

If you thought individual heat pump systems were complex for water heating or space conditioning in cold climates, how about combining these systems with one outdoor heat pump. This session will start off by sharing results from four field studies in single-family homes that were retrofitted with combi systems with varied complexity, followed by a performance comparison of a conventional heat pump setup to a combi heat pump setup, tested in two identical homes. We will then layer in thermal energy storage enhancements with phase change material and demonstrate a reduction in heat pump capacity by 40% to enable easier retrofit in existing multifamily buildings. Lastly, we'll focus on hydronic heat pump operation in three non-residential buildings for space conditioning and cover their design, layout, set points, and controls to gain practical knowledge on their performance and load shifting potential.

Moderator: **Amin Delagah**, TRC

Field Evaluation of Air-to-Water Heat Pumps in Minnesota

Presenter: **Samantha Hill**, Center for Energy and Environment (MNCEE)

Combi Heat Pumps: Findings from the Space Cooling & Domestic Hot Water (DHW) Season

Presenter: **Edward Louie**, Pacific Northwest National Laboratory

Compact, Cheap, and Clean: Air-to-Water Heat Pumps with Phase Change Material Thermal Energy Storage for Multifamily Residential Space and Water Heating

Presenter: **Kopchon Sittithammachoti**, Harvey Mudd College

Data from Hydronic Heat Pump System Field Sites: A Dive into Commercial System Design and Performance

Presenter: **Hillary Weitze**, Red Car Analytics

3:00–3:30 pm

Networking Break

Salon – prefunction South

3:30–5:00 pm

Concurrent Sessions

6A: Policies and Tools to Supercharge Heat Pump Adoption

Room 203

Continuation of session 5A: Policy Updates and Market Preparedness for Heat Pump Deployment

Policies at the state and federal levels can help transform the market for heat pump adoption. However, policy alone cannot result in transformation. Manufacturers, consumers, and installers need sufficient tools and resources to understand these policies and help achieve their objectives through the increased uptake of efficient heat pump technologies. This session, along with session 5A will seek to demonstrate the bridge between policy and transformation. This session will focus on new and innovative policy proposals to super-charge the adoption of heat pumps. Additionally, the session will explore new tools and resources that consumers and market actors can use to increase market acceptance and comfort with these products.

Moderator: **George Chapman**, Energy Solutions

Policies, Programs, and Technologies for Decarbonizing Existing Buildings in Disadvantaged Communities

Presenter: **Mark Umland**, Guidehouse

Cooling with Less (Global) Warming: Why Replacing Existing Air Conditioners with Heat Pumps Is a Key Climate Strategy

Presenter: **Meg Waltner**, Energy 350

Step by Step: Building Code Step Costs and Its Impact on Affordable Housing Supply

Presenter: **William Harvey**, Dunsky Energy + Climate Advisors

Tools for Navigating the Building Electrification Landscape: Helping Consumers, Utilities and Cities Affordably Decarbonize

Presenter: **James Milford**, Lumina Decision Systems

A New Home Electrification Economic Modeling Engine for Energy Professionals and Analysts

Presenter: **Ryan Shea**, RMI

6B: Systems: Cold-Climate Heat Pumps (CCHP)

Room 204

Cold-climate heat pumps have the potential to effectively heat homes in colder climates while lowering greenhouse gas emissions—but only if deployed widely. This panel will provide insight into the performance of new models of cold-climate heat pumps being developed under the Residential Cold Climate Heat Pump Challenge (CCHP Challenge). This session brings together a group of experts to discuss the lessons learned and findings to date from the CCHP Challenge as the initiative enters the second year of the field validation effort, sharing observations from the field, challenges uncovered along the way, and the potential impact of the CCHP Challenge on transforming one of the most challenging market segments.

Moderator: **Julia Rotondo**, Pacific Northwest National Laboratory

Panelists: **Payam Delgoshaei**, U.S. Department of Energy

Jeremy Sager, Natural Resource Canada

Vrushali Mendon, Pacific Northwest National Laboratory
Ali Kazmi, Guidehouse

6C: Multifamily: Extending the Work of the “Amazing Shrinking Room” Study into Solutions for Water Heating in Confined Spaces and Multifamily **Room 206**

It is hard to compete with electric resistance and or central boilers in multifamily. This session will explore how to efficiently heat water in multifamily or smaller single-family dwellings. Definitions of the challenges and exploration of ideas both modeled and proposed solutions.

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

Small Heat Pump Water Heater Systems: Design and Performance

Presenter: **Yanda Zhang**, ZYD Energy

A Systematic Modeling Study of Heat Pump Water Heater System for a Multifamily Building

Presenter: **Yanfei Li**, Oak Ridge National Laboratory

Heat Pump Water Heater Form Factors for Multifamily Dwelling Installations

Presenter: **Ben Larson**, Larson Energy Research

6D: Retrofit-Friendly Air-to-Water Combination Heat Pump Systems **Room 207**

Approximately 70% of annual furnace and boiler sales in the United States are for replacements, not new construction. Thus, accelerated decarbonization requires inexpensive and easily applied ways to adapt existing building infrastructure with minimum changes to electricity supply, thermal distribution, etc. Through field studies, market assessment, and simulations, our presenters address the perceived technical and field challenges to replace fossil fuel systems with heat pumps in residential and commercial buildings.

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

Revolutionizing Decarbonization: The Monoblock Heat Pump Solution for Existing Homes

Presenter: **Neil Bulger**, A2 Efficiency

High-Temperature Heat Pumps for Buildings Decarbonization

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

Hydronic Heat Pumps: Adding to Our Electrification Toolkit

Presenter: **Jonathan Heller**, Ecotope

5:00–6:00 pm **Shameless Commerce** **Salon East**

6:15–7:30 pm **Reception** **Courtyard North**

Thursday, March 14 – Hot Water Forum

7:00 am–4:00 pm **Registration** **201 Reg**

8:00–8:50 am **Breakfast** **Salon West**

9:00-10:30 am **Concurrent Sessions**

7A: Building Water Systems: Setting Goals for Water Quality, Hydraulic Performance, Energy Conservation, and Water Conservation **Room 203**

This session reports a blue-ribbon panel’s draft recommendations on building potable water system performance goals and design criteria that promote water quality, water conservation, and energy conservation. These categories of goals should be addressed simultaneously for potable water systems to meet their intended purposes and deliver adequate service for system users and owners. At present, goals and design criteria are scattered through codes, standards, and programmatic requirements and,

particularly in the case of water quality goals, are generally absent or unactionable. The session will begin with an overview of the goals development effort, including why goals are needed, who is developing the goals, what outputs are planned and the effort's timeline. Subject matter experts will then outline biological water quality goals, chemical water quality goals, hydraulic and thermal goals and how the goals are interconnected. Session participants will be provided opportunities for commenting on the draft goals and influencing the final goals. The session will conclude with a group exercise in which the audience will assess the ability of the water systems of a "green" school to meet the goals and opportunities for improving the system's performance and better meeting goals.

Moderator: **Tania Ullah**, National Institute of Standards and Technology

Panelists: **Tim Bartrand**, ESPRI

Jim Lutz, Hot Water Research

Becky Tallon, A.O. Smith

7B: Equity & Affordability: Heat Pump Water Heaters in Low-Income Areas

Room 204

Moderator: **Maggie Kelley Riggins**, Southeast Energy Efficiency Alliance

Increasing Equitable Access to Heat Pump Water Heaters: A Paper on Strategies and Best Practices

Presenter: **Joseph Wachunas**, New Buildings Institute

North Carolina Demand Response Heat Pump Water Heaters for Low-Income Homes

Presenters: **Helen Davis**, Energy Solutions

Daniela Urigwe, Energy Solutions

7C: Models, Sizing, and Reality, Oh My!

Room 206

Hot water system sizing methods date from at least 30 years ago. The energy models date from the late 1970s, with periodic updates in the intervening years. Neither the sizing methods nor the energy models match what actually happens in buildings. This makes it difficult to properly account for improvements to system efficiency. This session will discuss the sizing for different scales of multifamily buildings. It will also present the work PNNL is doing to revise the hot water system modeling for IECC-Residential and for ASHRAE 90.1.

Moderator: **Gary Klein**, Gary Klein & Associates

Giving Credit for Good Plumbing Design

Presenter: **Cary Faulkner**, Pacific Northwest National Laboratory

Incorporating Realistic Designs into Energy Models for Improved Energy Savings Analysis

Presenter: **Carmen Cejudo**, Pacific Northwest National Laboratory

Investigating Domestic Hot Water Heater Sizing Issues

Presenter: **Alyza Khan**, Lincus Inc.

State of the Art Multifamily Hot Water Plumbing and Production

Presenter: **Peter Skinner**, E2G Solar LLC

7D: Smart Grid: Grid Interactivity

Room 207

Buckle up for a deep dive into the hot (water) topic of grid-interactive water heaters! This session will uncover the secrets to unlocking their flexibility, from optimizing control systems to navigating rate structures. Get ready to shift your perspective on water heating as we explore how these unsung heroes can become smart grid superstars, boosting efficiency, saving costs, and supporting a resilient energy future.

Moderator: **Scott Spielman**, Ecotope

Distributed Energy Resource Conformance

Presenter: **Dana Paresa**, Portland State University

Designing Better Model Predictive Controllers to Maximize the Flexibility of Grid-Interactive Water Heaters

Presenter: **Elizabeth Buechler**, Stanford University

Grid-Interactive Load Flexibility Control of Multifamily Heat Pump Water Heater Systems

Presenter: **Greg Pfothenauer**, Artemisia Energy

Navigating Connection Options, Thermostatic Mixing Values (TMV), Time-of-Use (TOU) Rates and Their Impacts on Water Heating Daily Load Shifting

Presenter: **Amélie Besson**, Association for Energy Affordability

Heat Pump Water Heater Load Shifting Meta Analysis

Presenter: **Noah Gabriel**, New Buildings Institute

Central CO2 Heat Pump Water Heater Performance and Load Shifting in Multifamily Buildings

Presenter: **M M Valmiki**, ASK Energy

10:30–11:00 am

Networking Break

Salon – prefunction South

11:00 am–12:30 pm

Concurrent Sessions

8A: You've Probably Never Thought About This: The Intersection between Energy Efficiency Research, Codes and Regulations, and Water Safety

Room 203

Energy advocates often focus on equipment or system performance and the importance of the energy code, but builders, plumbers, contractors, and inspectors are responsive to a larger suite of real-world considerations. Specifically, these market actors need to be mindful of, and responsive to, codes, standards and requirements surrounding health, safety and building performance. Many times, new technology adoption is hindered because advocates do not fully incorporate these codes into programs or design considerations, or fully appreciate the considerations of market actors who are responsible for their enforcement. This session will provide attendees information about these codes, how they may impact system design and installation, and steps they can take to mitigate potential unintended consequences. These are the issues that plumbers and installers think about every day and understanding their concerns, and ensuring the codes reflect innovations in technology, can ensure more effective market acceptance and adoption of efficient technologies and systems.

Moderator: **George Chapman**, Energy Solutions

The Research and Codes Nexus: The Hot Water System Revolution

Presenter: **Christoph Lohr**, IAPMO

Findings from Four CalNEXT Projects Relating to Heat Pump Water Heaters in Commercial Kitchens

Presenter: **Amin Delagah**, TRC

8B: Programs & Lessons Learned: Water Heating

Room 204

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

TECH Clean California Heat Pump Water Heater Incentives: Accelerating Load Management through Flexible Water Heating

Presenter: **Emily Kehmeier**, Energy Solutions

Guidance on Domestic Hot Water Heat Pump Design in Multifamily Residential Buildings

Presenters: **Stuart Hood**, Introba

Harriet Lilley, Introba

Saving the Grid with Water Heaters – The South African Way

Presenter: **Jessie Yen**, University of Witwatersrand, Johannesburg

Heat Pumping in the Great Lakes Peninsulas: Lessons Learned from Heat Pump Contractor Education and Collaboration in Michigan

Presenter: **Justin Margolies**, Slipstream

8C: Bringing Hot Water System Sizing into the 21st Century**Room 206**

Current practice in sizing hot water systems is based on data from the early 1990s: before the 1992 EPACT, which put limits on flow rates for faucets and shower heads, and before water-efficient dishwashers, washing machines, and commercial equipment came on the market. ASHRAE guidelines for peak daily hot water demand for apartments vary by a factor of 4.5, from 90 Gal/person per day to 20 Gal/person/day. In addition to outdated estimates of hot water usage, the sizing methods do not properly include the energy needed for temperature maintenance systems or other losses in the distribution system. These losses typically account for about 30% of the energy use of a water heating system in an apartment building but there is almost no data or guidance related to how to size or optimize this component of the energy demand. This session will focus on how to improve sizing methodologies to include the energy for the uses and for the delivery losses based on modern information about hot water use in multifamily and other commercial buildings.

Moderator: **Keshmira McVey**, Bonneville Power Administration

Panelists: **Nicole Ceci**, Steven Winter and Associates

Jon Heller, Ecotope

Jack Aitchison, AEA

8D: Smart Grid: Load Shifting & Heat Pump Water Heaters (HPWHs)**Room 207**

This presentation will cut through complexity, revealing the tools and techniques to unlock the grid flexibility of commercial heat pump water heaters (CHPWH). We'll start by unpacking current methods used to estimate load shift capacity in California's Self Generation Incentive Program. Then we will delve into Northwest Energy Efficiency Alliance's innovative test methods, which draw from AHRI 1430 and are designed to measure load-shifting capabilities. We'll explore the evolving landscape of load-shifting needs and regulations, including the importance of standards like CTA-2045-B. Whether you're a utility, developer, equipment manufacturer, distributor, or energy professional, this presentation will bring you up to speed on the latest methods used to quantify load shift capacity in CHPWHs.

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

Multifamily Grid-Interactive Central System Heat Pump Water Heater (GIWH) Demonstration Projects

Presenter: **Tristan de Frondeville**, SkyCentrics

Glimpse Into the New Load-Shifting Needs and Requirements for Central Heat Pump Water for Multifamily Leveraging CTA 2045 for Larger Loads

Presenter: **Scott Spielman**, Ecotope

Electrification Options for Multifamily Water Heating in Cold Climates

Presenter: **Zhenning Li**, Oak Ridge National Laboratory

12:30–1:30 pm**Networking Lunch****Salon West****1:30–3:00 pm****Concurrent Sessions****9A: Policies and Tools to Supercharge Heat Pump Adoption****Room 203**

Building codes are one of the largest greenhouse gas reduction opportunities when it comes to water heating. Additionally, these codes can effectively address system design considerations and help ensure that products and systems are operating as intended and building owners and consumers are able to benefit from efficient technologies without the loss of consumer amenity. In recent years, the California Title 24 building code has been on the leading edge of developing codes that support the decarbonization of water heating systems. This session will provide highlights and examples from the most recent updates to Title 24 related to hot water systems. These presentations will cover not only the changes themselves, but also the analysis underpinning those changes and an overview of the technologies and design considerations leading to the final code language. Attendees will have the opportunity to learn about

system design, savings potential, and innovative ways to update building codes to support decarbonization of hot water in buildings.

Moderator: **George Chapman**, Energy Solutions

Central Heat Pump Water Heater Requirements

Presenter: **Jingjuan Dove Feng**, TRC Companies

Electric Ready Measures

Presenter: **Jose Garcia**, TRC Companies

Distribution System Measures

Presenters: **Amin Delagah**, TRC Companies

James Haile, Frontier Energy

9B: Workforce: Heat Pump Water Heaters

Room 204

Moderator: **Sarina Sawyer**, Southeast Energy Efficiency Alliance

Heat Pump Water Heater Industry Resources Coming of Age

Presenter: **Paul Campbell**, ICF

Adapting to Change: Ethnographic Insights on Installing Heat Pump Water Heaters in Cold-Climate Zones

Presenter: **A. Maass**, Illume

The Pursuit of Updating State Technical Resource Manuals (TRM): Ensuring Robust Heat Pump Water Heater Rebates!

Presenter: **Nathaniel Jutras**, U.S. Environmental Protection Agency – ENERGY STAR

9C: Optimizing Hot Water Distribution Systems

Room 206

An ideal hot water distribution system is one in which the water is heated in the plumbing fixtures and appliances. No distribution system losses, but lots of water heaters. The other extreme is where one water heater serves a garden apartment complex. One water heater and very long distribution system piping, with correspondingly large losses. This session will discuss the impact of distribution losses on central electric HPWHs, methods of balancing parallel-path risers, the performance of a semi-centralized hot water system, and the performance of several HPWH systems serving a men's halfway house.

Moderator: **Tania Ullah**, NIST

Existing Multifamily Domestic Hot Water (DHW) Distribution Issues and Impact on Central Heat Pump Water Heater Retrofits

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

How to Enhance Comfort and Efficiency by Effective Balancing of Hot Water Distribution Systems in a Multifamily Building: Lab Evaluation of Different Balancing Methods

Presenter: **Mehdi Zeyghami**, Pacific Gas & Electric Company

Bringing Plumbing into the Energy Reference Models

Presenter: **Stephen Zimmerman**, NIST

9D: Systems: 120V Heat Pump Water Heaters: The Field Experience of Plugging into the Future

Room 207

This session will present recent results of current field trials in the Midwest and New Orleans. Presenters will also report on studies examining load shifting controls and potential maximum First Hour Ratings for 120V heat pump water heaters.

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

Plugging in for Hot Water in Cold Climates: 120V Heat Pump Water Heaters in the Midwest

Presenter: **Kevin Gries**, Slipstream

Lessons Learned from the Field: Challenges and Opportunities from 120V Heat Pump Water Heater Deployment in New Orleans

Presenter: **Tyler Pilet**, Pacific Northwest National Laboratory

Field Monitoring Advanced Load Shifting Controls for 120V Heat Pump Water Heaters

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

Max Tech First Hour Rating for 120v Heat Pump Water Heaters

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

3:00–3:30 pm **Networking Break** **Salon – prefunction South**

3:30–5:00 pm **Concurrent Sessions**

10A: Residential Water Heating installation **Room 203**

Learn how industry experts are addressing barriers to heat pump water heater installation.

Moderator: **Deepti Dutt**, Northeast Energy Efficiency Partnerships

The Path of Least Resistance: A Performance Evaluation of Residential Hybrid Electric Heat Pump Water Heaters

Presenter: **Saroj Karki**, DNV

The Return of the Amazing Shrinking Room

Presenters: **Maya Gantley**, 2050 Partners

Decker Ringo, 2050 Partners

Overcoming Challenges: Heat Pump Water Heater Installation Tool

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

10B: Commercial Gas Heat Pump Water Heaters (GHPWH) and Market Transformation

Room 204

Despite notable performance improvements in electric water heaters over the past two decades, enhancements in commercial gas water heater efficiency have been limited due to challenges in design complexity, high first costs, and a limited understanding of the value proposition to building owners, developers, and designers for efficient gas water heating solutions. Market transformation actions have the potential to reduce these barriers to commercial gas heat pump water heater adoption and increase gas savings and decarbonization opportunities with this technology. Join our panel of experts to learn more about developments in commercial gas heat pump water heating from around the country.

Moderator: **Jack Davidson**, NEEA

Studying Application of GAHPs in DHW Systems

Presenter: **Cristalle Mauleon**, Lincus Inc.

Heat Pump Performance in California: Fuel-Fired Water Heating Applications

Presenter: **Madeline Talebi**, ICF

Codes and Standards Review for State-of-the-Art Gas Absorption Heat Pump Water Heaters

Presenter: **Arjun Thirumaran**, GTI Energy

10C: Multifamily Water Heating Case Studies + Tips and Tools to Accelerate Market Adoption

Room 206

Experts will share their experience and learnings and offer tips and tools such as a Qualified Products List to deploy scalable, efficient, and reliable central hot water systems.

Moderator: **Keshmira McVey**, Bonneville Power Administration

Technoeconomic Analysis of Novel Heat Pump Water Heaters for Families with High Energy Burden in Cold Climates

Presenter: **Joseph Rendall**, Oak Ridge National Laboratory

Multifamily Decarbonization: Making an Equitable Transition

Presenter: **Joy Ward**, Stewards of Affordable Housing for the Future

Advanced Water Heater Specification 8.1, QPL and Scalable, Affordable, Effective, Electrification in the West

Presenter: **Jonathan Heller**, Ecotope

10D: Innovative Solutions and Emerging Technology

Room 207

Exploring the many configurations to leverage heat pumping technology continues with all fuel types. This session will explore phase change materials into heat pump water heaters, thermally driven heat pump water heaters, and photovoltaics with thermal energy storage. Join us to learn about expected performance and functionality of these emerging technologies.

Moderator: **Noe Contreras**, Northwest Energy Efficiency Alliance

Unlocking the Potential of Embedded Phase Change Materials Thermal Energy Storage Heat Pump Water Heaters

Presenter: **Stephen Kowalski**, Oak Ridge National Laboratory

Service Hot Water Heating with Photovoltaics and Thermal Energy Storage

Presenter: **Alejandro Baez Guada**, GTI Energy

Laboratory Evaluation of Thermally Driven Absorption Heat Pump for Domestic Hot Water

Presenter: **Abbas Ahsan**, GTI Energy

Theoretical Analysis of a Vapor-Compression Ejector Heat Pump Water Heater

Presenter: **Jeremy Spitzenberger**, University of Missouri-Columbia Department of Mechanical and Aerospace Engineering