American Council for an Energy-Efficient Economy

Hot Water Forum

Water Heating, Distribution, and Use Efficiency

Hilton Downtown • Nashville, TN • February 22-24, 2015

CONFERENCE PROGRAM

Sunday, February 22

12:00 pm to 7:00 pm	**REGISTRATION OPEN**	*Prefunction*
5:00 pm to 7:00 pm	**WELCOME RECEPTION**	*Prefunction*

Monday, February 23

7:30 am to 7:30 pm	**REGISTRATION OPEN**	*Prefunction*
8:00 am to 9:00 am	**CONTINENTAL BREAKFAST**	*Armstrong/Boone*
9:00 am to 9:30 am	**WELCOME**	*Crockett*

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

9:30 am to 10:30 am	**PLENARY SESSION**	*Crockett*

Perspectives on the 2015 Water Heater Minimum Efficiency Standards

Speakers: **Anthony Bouza**, *U.S. Department of Energy*
Adam Darlington, *Navigant*
Frank Stanonik, *Air-Conditioning, Heating, & Refrigeration Institute*
Keith Dennis, *The National Rural Electric Cooperative Association*

This session will cover:

- What is the new standard and why do we have it?
- The new rating method explained
- What industry is doing and what to expect
- How does this affect grid-connected water heaters, demand response, and what is the path forward?

Description: The 2015 Water Heater Minimum Efficiency Standards begin mandatory adoption of higher efficiency levels for water heaters larger than 55 gallons, offering potential for large energy savings. Simultaneously, DOE is adopting a new test procedure that extends coverage; divides water heaters into four capacity-based categories; and uses different but more realistic tests for each class. Our speakers, all prime movers in the processes, will address aspects and implications of these momentous changes, the largest ones in the history of water heater regulation.

10:30 am to 11:00 am **AM BREAK** *Prefunction*

11:00 am to 12:30 pm **CONCURRENT SESSIONS**

Session 1A *Ryman 1*

Combined Space and Water Heating Systems

Session Moderator: **Ben Schoenbauer,** *Center for Energy and Environment*

Speakers: **Ben Schoenbauer,** *Center for Energy and Environment*
Intro. to the Technology and a Discussion of Lessons Learned from a 200 System Install Project
David Kalensky, *Gas Technology Institute*
Results from Gas Technology Institute's Field Studies
Thomas Butcher, *Brookhaven National Laboratory*
Improving the DHW Performance of Common Tankless Coil Boilers
John Porterfield, *eZing Inc.*
How to Get a Forced-Air Combi Installed

Description: This session will cover lessons learned from both field and lab testing of combined space and water heating systems. It will explore how this will influence a system design and implementation guidelines for combined space and water heating systems that CEE is creating.

Session 1B *Ryman 2*

Commercial Kitchens: New Technologies in the Marketplace for Heat Recovery

Session Moderator: **Amin Delagah,** *Fisher-Nickel, Inc.*

Speakers: **Bob Prasser,** *Dragon Fire Thermo Recovery Filter*
Dragon Fire Thermo Recovery Filter for Kitchen Ventilation Exhaust Hoods
Fuoad Parvin, *Halton Company*
Halton Heat Reclaim Back-Shelf Hood
Benoit Champoux, *Novothermic Technologies Inc.*
Novothermic Drain Water Heat Recovery Device for Dishwashers

Description: This session explores three new technologies in the marketplace that recover waste heat from commercial kitchen equipment and transfer this energy to preheat domestic hot water.

Session 1C *Ryman 3*

Heat Pump Water Heater Technology in Colder Climates

Session Moderator: **Jill Reynolds,** *Northwest Energy Efficiency Alliance*

Speakers: **Dave Kresta,** *Northwest Energy Efficiency Alliance*
NEEA's Heat Pump Water Heater Initiative and the Northern Climate Specification
Hugh Henderson, *CDH Energy*
Findings from Northern Climate Field Study
Ben Larson, *Ecotope*
Ben Ealey, *Electric Power Research Institute*

Description: Heat pump water heaters are an obvious choice in warm, humid climates, but how are they performing in cooler climates? This session will cover real world performance of heat pump water heater technology in the Northwest and the Northeast. Additionally, panelists will discuss optimization of product specifications to meet broad climate needs and harness the energy savings potential of this technology.

Session 1D *Robertson*

Grid-Interactive Water Heating (GIWH): Technology, Policy, and the Path Forward

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

Speakers: **Keith Dennis,** *National Rural Electric Cooperative Association*
Washington DC Policy Update
Alex Hofmann, *American Public Power Association*
Hot Water and Load Control - The Municipal Utility Perspective
Robin Roy, *National Resource Defense Council*
Efficiency Standards, Environmental Performance, and Water Heating Technology
David Podorson, *eSource*
Adopting GIWH: Lessons Learned from Past Water Heater Utility Programs

Description: Grid-Interactive Water Heating is poised to move from field tests and pilot projects to MW-scale implementation for electric utilities across the country. Simultaneously, increasing amounts of variable renewable energy is being integrated onto the grid, ancillary service markets are developing, and water heating efficiency standards are evolving. Join us for a discussion on how polices and technologies interact and continue to evolve grid-interactive water heating.

12:30 pm to 1:30 pm **LUNCH** *Armstrong/Boone*

1:30 pm to 3:00 pm **CONCURRENT SESSIONS**

Session 2A *Ryman 1*

Market Ready Gas Heat Pump Water Heaters

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

Speakers: **Mike Garrabrant,** *Stone Mountain Technologies Inc.*
Commercial Water Heating and Residential Combo Applications Using Gas Heat Pumps
Paul Glanville, *Gas Technology Institute*
Field Testing Results for Residential Gas-Fired Heat Pump Water Heaters
Ellen Makar, *Energy Concepts*
Industrial Heat Pumped Hot Water

Description: With gas EFs well over 1.0, gas-fired heat pumps have the potential to leapfrog condensing gas technology – if offered at low enough prices. This session covers diverse approaches to developing residential and commercial heat pump water heaters for the US market, based on absorption (liquid) and adsorption (solid) cycles. *A complementary session on Gas Heat Pump Water R&D is offered in Session 4B.*

Session 2B *Ryman 2*

Keeping Water Heaters Alive

Session Moderator: **Larry Weingarten**

Speakers: **Jens Gruetzmann,** *Magontec GmbH*
Tanks: Extending Their Lifetime with Corrosion Protection
Randy Schuyler, *Water Heater Rescue*
Heater Maintenance: The Good Old Days Are Gone
Larry Weingarten
Missed Opportunities: Maintenance and Design

Description: This session will explore the maintenance of water heaters such as protecting both mild steel and stainless steel tanks from corrosion and their necessary maintenance for a long life. Water heater maintenance relating to education and vigilance will also be discussed as well as missed opportunities in maintenance and design for keeping water heaters running longer.

Session 2C *Ryman 3*

Up a Stream with More than a Rebate: Efficiency Programs at the Distributor Level

(Upstream and distributor level efficiency program approaches)

Session Moderator: **George Chapman,** *Consortium for Energy Efficiency*

Speakers: **Jennifer Parsons,** *The United Illuminating Co.*
Jesus Pernia, *Eversource*
Jennifer Ryan, *Shelton Winnelson*
Hector J. Lefbad, *Energy Solutions*

Description: Moving the rebate process from a downstream (ie. Mail-in) consumer submission to an upstream submission at the distributor level, has proven to be an effective means of capturing larger volumes of high efficiency equipment sales, while also creating a market shift from conventional, code equipment to high efficiency equipment. This session will highlight some of the successes these programs have experienced by reaching beyond the customer to the distribution chain, and how this approach can fast-track market transformation. This session will focus on programs and distributors with experience implementing these types of programs, with lessons learned, and a guide to best practices so others can learn from these early leaders on this topic.

Session 2D *Robertson*

From Grid-Responsive to Grid-Interactive: The Control Provider's Perspective

Session Moderator: **Steve Koep,** *Vaughn Thermal Corporation*

Speakers: **Conrad Eustis,** *Portland General Electric and CEA 2045*
Cody Chambers, *Comverge*
Kelly Murphy, *Steffes*
Dan Flohr, *Sequentric*
Ivan Kustec, *Emerson*
Pete Harbin, *Carina*
Steve Koep, *Vaughn Thermal Corporation*
Joe Childs, *Eaton*

Description: As we move toward the Internet of Things, it's important to recognize the trend from pre-programmed stand-alone timers and one-way radio-control devices (grid-responsive) to high-speed, two-way communication (grid-interactive) and the variety of ancillary services (frequency control, etc.) that are enabled. From communication protocols to grid-interactive functionality, the panel participants will share their perspective on the evolving market opportunity.

3:00 pm to 3:30 pm **PM BREAK** *Prefunction*

3:30 pm to 5:00 pm **CONCURRENT SESSIONS**

Session 3A *Ryman 1*

CO_2 Heat Pump Water Heaters for the US Market

Session Moderator: **Omar Abdelaziz,** *Oak Ridge National Laboratory*

Speakers: **Ben Larson,** *Ecotope*
Energy Efficiency in the Northwest: the Role of CO_2 Split Water Heating Systems
Kyle Gluesenkamp, *Oak Ridge National Laboratory*
Development of Low-Cost ENERGY STAR®-Qualified Residential CO_2 HPWH Prototype
John Miles, *Sanden, USA*
Design and Development of Split CO_2 Heat Pump Water Heater for the North American Market

Description: Heat pump water heaters using CO_2 have shown extremely high COPs and high service temperatures. Can they be successful on a large scale in US markets? Speakers from industry, utility and research laboratories will cover testing on split water heating systems; laboratory testing in the US for high temperature commercial applications; development of a prototype for low cost while meeting ENERGY STAR® criteria; and the prospects for CO_2 water heating in the US.

Session 3B *Ryman 2*

Opportunities and Challenges: Heat Pump Water Heater Technology and Demand Response

Session Moderator: **Dave Kresta,** *Northwest Energy Efficiency Alliance*

Speakers: **Charlie Stephens,** *Northwest Energy Efficiency Alliance*
Heat Pump Water Heaters for Demand Response and Energy Storage
Philip Boudreaux, *Oak Ridge National Laboratory*
Set Point Schedules and Advanced Control of HPWHs for Load Shifting and Energy Savings
Sarah Widder, *Pacific Northwest National Laboratory*
Demand Response Capability of Heat Pump Water Heaters

Description: New electric water heater efficiency standards set to take effect in April of 2015 will require electric water heaters larger than 55 gallons to have a minimum Energy Factor effectively requiring them to be HPWHs. Interveners to this standard have questioned whether or not HPWHs are capable of providing a variety of Demand Response capabilities. This session will explore several studies that have looked at the opportunities and challenges of using HPWHs for a variety of DR-related capabilities, including peak shifting, energy storage, and ancillary services.

Session 3C *Ryman 3*

A Closer Look at Behavioral Waste

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

Speakers: **Jim Lutz,** *Lawrence Berkeley National Laboratory*
Water, Energy Use, and Waste Monitoring in Hot Water Distribution Systems in CA Residences
Troy Sherman, *Evolve Technologies, LLC*
Understanding Behavioral Waste in the Shower and its Impact on Energy Efficiency
Chris Kirn, *AquaPedal LLC*
A Systematic Behavior-Based Approach to Product Design Resulting in Enormous Water and Energy Savings
Larry Acker, *ACT Inc. D'MAND Systems*
The Grieshop Report: The Arizona Study of Over 100 Existing Homes On Site Reviewing the Value of Controlled Hot Water Distribution and the Effect of Water and Energy Savings

Description: This session will explore the latest research and findings on behavioral waste including hot water waste at showers, unintended waste at sinks, and new techniques for estimating savings from demand controlled pumping.

Session 3D *Robertson*

Utility Pilot Projects and Programs: Load Management to Grid Interactivity

Session Moderator: **Harshal Upadhye,** *Electric Power Research Institute*

Speakers: **Michael Browder,** *Carina Technology, Inc.*
BTES/TVA/EPRI/Carina Water Heater Demand Management/Valley Fill Study
Eric Rehberg, *Battelle*
HECO GIWH Pilot Project
Austin Zeller, *Steffes Corporation*
Hawaii Case Study

Description: This session will focus on field trials of the Grid Interactive Water Heaters. Speakers who have first-hand end-to-end experience of deploying this technology will share their stories backed up by field data. Join us to learn more about the research, product development and market development efforts currently underway to facilitate the implementation of GIWH technology on a broad scale.

5:00 pm to 6:00 pm **LIGHTNING SESSION** *Ryman 1*

Shameless Commerce: Introducing New Products and Services

Description: In this session, we'll deviate from our usual norms, and offer anyone a few minutes to present new products or services, with their advantages, features, availability, etc.

5:30 pm to 7:30 pm **RECEPTION** *Crockett*

7:30 pm **EVENING INFORMAL SESSION** *Ryman 1*

Challenging the Myth that Solar Thermal is Dead

Session Moderator: **Larry Weingarten**

Description: By using low tech solar collectors and an electric storage tank in an unusual manner, we've been able to build a solar DHW system that is simple, inexpensive, reliable and able to handle about 95% of the hot water load. In this session we'll share the details of design and construction.

Tuesday, February 24

7:30 am to 5:00 pm **REGISTRATION OPEN** *Prefunction*

8:00 am to 9:00 am **CONTINENTAL BREAKFAST** *Armstrong/Boone*

9:00 am to 10:30 am **CONCURRENT SESSIONS**

Session 4A *Ryman 1*

Real World Monitored Data on Hot Water Energy and Water Use

Session Moderator: **Nehemiah Stone,** *Benningfield Group Inc.*

Speakers: **Neil Donnelly,** *New Ecology, Inc.*
Andrew Proulx, *New Ecology, Inc.*
Eric Ansanelli, *Levy Partnership*

Description: What are the real-world domestic hot water system loads and efficiencies in multifamily buildings? Testing has determined tenant usage patterns, system losses and issues with controls and system components. We'll be digging into the actual losses being seen in these systems, how system sizing compares to ASHRAE requirements, and ways that these data can inform recommendations for equipment and system design for multifamily buildings.

Session 4B *Ryman 2*

Gas Heat Pump Water Heater Research and Development

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

Speakers: **Moonis Ally,** *Oak Ridge National Laboratory*
High Efficiency, Residential Gas-Fired Adsorption Heat Pump Water Heater Development
Saeed Moghaddam, *University of Florida*
A Compact Ionic Liquid-Based Water Heater Enabled by Membrane-Based Absorption Technology
Don Erickson, *Energy Concepts*
Thermal Heat Pumps- A New Paradigm for Water Heating

Description: This session will explore the latest research and development on gas heat pump water heaters. *A complementary session on Gas Heat Pump Water R&D is offered in Session 2A.*

Session 4C *Ryman 3*

Updates from the Field I: ENERGY STAR® Residential Water Heaters and Efficiency Programs

Session Moderator: **Mark Michalski,** *Cadmus*

Speakers: **Steve Ryan,** *U.S. Environmental Protection Agency*
George Chapman, *Coalition for ENERGY STAR® Water Heaters*
Carlos Ruiz, *Southern California Gas Company*

Description: New minimum standards and test methods have prompted a change in specifications for *ENERGY STAR® water heaters*. Additionally, new resources, education materials and capabilities have been added to help customers, installers, contractors and builders understand and promote the benefits of high efficiency water heaters. This session will provide an update of activities at ENERGY STAR® as well as an overview of how efficiency programs are promoting these products.

Session 4D *Robertson*

Variable Speed Multi-split Heat Pump Water Heaters

Session Moderator: **Paul Doppel,** *Mitsubishi Electric*

Speakers: **Tim Roller,** *Mitsubishi Electric*
Testing of Variable Speed Multi-Split Heat Pump Water Heater Systems
Dave Kresta, *Northwest Energy Efficiency Alliance*
Field Testing Results
Paul Doppel, *Mitsubishi Electric*
Rating Methods and Regulatory Issues

Description: This session is a follow-up from the 2013 Hot Water Forum panel when the presenters discussed the emergence of inverter-driven compressor systems into the water heating marketplace and talked about some of the complications. We will explore commercial inverter-driven, multi-split systems, or as they are better known, Variable Refrigerant Flow (VRF) systems and how US engineers are finding interesting ways to incorporate these systems. The panel will also reflect on how the ASHRAE Standard 206, "Method of Testing for Rating of Multi-Purpose Heat Pumps for Residential Space Conditioning and Water Heating" works for these very complex systems.

10:30 am to 11:00 am **AM BREAK** *Prefunction*

11:00 am to 12:30 pm **CONCURRENT SESSIONS**

Session 5A *Ryman 1*

International Test Procedures and Standards

Session Moderator: **Jim Lutz,** *Lawrence Berkeley National Laboratory*

Speakers: **Jim Lutz,** *Lawrence Berkeley National Laboratory*
David Villarroel, *Natural Resources Canada*
Results of Comparing Canadian Electric Water Heater Test Methods C191-13 and C191-04

Description: The US and EU residential water heater test procedures are based on a 24-hour simulated use test and use different draw patterns to rate water heaters with different capacities. South Africa is implementing changes to the minimum efficiency standards for geysers (water heaters) that have significant differences from the US. This presentation will discuss the independent testing behind the new changes.

Session 5B *Ryman 2*

New Algorithms for Understanding Hot Water Use in Multifamily Buildings

Session Moderator: **Nehemiah Stone,** *Benningfield Group Inc.*

Speakers: **Sean Armstrong,** *Redwood Energy*
Amy Dryden, *Build It Green*
Troy Sherman, *Evolve Technologies, LLC*
Gerald Van Decker, *RenewABILITY Energy, Inc.*

Description: From 2012-2014, an informal working group met monthly to develop a research-based strategy for predicting water use by fixture type and occupancy of housing. These algorithms are uniform for both single family and multifamily housing. Model participants included Mayer, DeOreo, Van Decker, Klein, Schein, Lutz, Sherman, Parker, Fairey, Zhang, Stone, Dryden, Dakin, Selover, and Ownby.

Session 5C *Ryman 3*

The Front Lines: Helping Installers Understand and Promote High Efficiency

Session Moderator: **Philip Picotte,** *Consortium for Energy Efficiency*

Speakers: **George Chapman,** *Coalition for ENERGY STAR® Water Heaters*
Jerry Ryan, *New Jersey Natural Gas*

Description: Today, ENERGY STAR® and the Coalition for ENERGY STAR® Water Heaters are working together to provide tools and resources for contractors and installers to understand and promote the benefits of high efficiency products for their customers. This session will provide an update on the resources being developed; the opportunities for collaboration and promotion; and a view from the installer perspective on the benefits and barriers of promoting high efficiency.

Session 5D *Robertson*

Changes to the 2015 Plumbing and Energy Efficiency Codes that Impact Hot Water Use

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

Description: Many changes have been made to the 2015 IECC residential and commercial chapters and to the 2015 UPC. This session will discuss these changes and their implications. Come see how your business can take advantage of these changes.

12:30 pm to 1:30 pm **LUNCH** *Armstrong/Boone*

1:30 pm to 3:00 pm **CONCURRENT SESSIONS**

Session 6A *Ryman 1*

Commercial Kitchens: The Importance of Sub-Metering- Current Methods and Future Integration

Session Moderator: **Amin Delagah,** *Fisher-Nickel, Inc.*

Speakers: **Amin Delagah,** *Fisher-Nickel, Inc.*
Lessons Learned & Benefits of Sub-Metering at Conveyor Dishwashers & at the Water Heater
Reynaldo Gil, *ReyLabs Inc.*
Distributed and Mobile Analytic System for Optimizing Equipment Efficiency

Description: The first speaker will cover lessons learned from sub-metering of recent field monitoring studies on commercial dishwashers and water heaters. The second speaker will discuss the integration of low-cost wireless sensors and metering hardware into equipment utilizing smart phones and software to communicate with the operator. Shifting from using expensive sub-metering equipment to simple wireless solutions will make it easy for operators to check in on their equipment and get text alerts if there is a problem.

Session 6B *Ryman 2*

Measuring the Performance of Advanced Gas Water Heaters

Session Moderator: **Ben Schoenbauer,** *Center for Energy and Environment*

Speakers: **Paul Glanville,** *Gas Technology Institute*
Impacts of the New DOE Final Rule Making for Water Heaters
Ben Schoenbauer, *Center for Energy and Environment*
A Field Study of Hybrid Water Heaters Designed For Retrofit Applications
Tim Kingston, *Gas Technology Institute*
Designing Advanced Gas Water Heaters for High Performance in DHW-only and Combi-System Applications

Description: This session will provide new laboratory and field research data on measuring the performance of advanced gas water heaters which go beyond the current ENERGY STAR® rating. The first speaker will examine the impact of the new DOE method of testing on gas water heaters, conventional and advanced. The second speaker will explore the installed performance of high performance retrofit gas water heaters. The remaining speakers will cover their research on how the performance of these advanced gas water heaters can be improved in whole-house water heating and in combined space/water heating applications.

Session 6C *Ryman 3*

Updates from the Field II: ENERGY STAR® Commercial Water Heaters and Efficiency Programs

Session Moderator**:** **George Chapman,** *Consortium for Energy Efficiency*

Speakers: **Philip Picotte,** *Coalition for ENERGY STAR® Water Heaters*
Nate Strong, *Eversource*
Steve Ryan, *U.S. Environmental Protection Agency*

Description: The ENERGY STAR® program for high efficiency commercial water heaters is a relatively new product category and often represent a small portion of efficiency program portfolios. However, this is an area with significant opportunity for additional savings, especially for high-use commercial customers. ENERGY STAR® has developed new resources, education materials and capabilities to help business owners, installers, contractors and builders understand and promote the benefits of high efficiency water heaters. This session will provide an update of activities at ENERGY STAR as well as an overview of how efficiency programs are promoting these products.

Session 6D *Robertson*

Energy Budget Calculations

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

Speakers: **Gerald Van Decker,** *RenewABILITY Energy Inc.*
Jim Lutz, *Lawrence Berkeley National Laboratory*
Sean Armstrong, *Redwood Energy*

Description: Up until this year, energy calculations in RESNET-HERS for hot water was not able account for reductions in hot water use, only for water heater efficiency or the use of solar heating. This session will be a panel discussion on the new calculation methods, as well as proposed changes for the water heating energy calculations for California's Title 24.

3:00 pm to 3:30 pm **PM BREAK** *Prefunction*

3:30 pm to 5:00 pm CONCURRENT SESSIONS

Session 7A *Ryman 1*

Bringing the Internet of Things to Hot Water

Session Moderator: **Jim Lutz,** *Lawrence Berkeley National Laboratory*

Speaker: **Matthew Carlson,** *Sunnovations*

Description: The internet is sneaking into all sorts of unexpected places (i.e. thermostats) these days. What are some of the impacts this is having on our water heaters? Hear stories of manufacturers talking to their water heaters in the field, how consumers are talking to their water heaters, and what utilities are doing with smart water heaters in their territories. This will be a wide open discussion of what's happening now and speculation of what's to come.

Session 7B *Ryman 2*

Multifamily Buildings: How Screwed up is Typical Plumbing in Multifamily Buildings?

Session Moderator: **Nehemiah Stone,** *Benningfield Group Inc.*

Speakers: **Larry Acker,** *ACT Systems*
John Neal, *Association for Energy Affordability*
Skye Gruen, *Bright Power*

Description: This session is about showing the wrong and right way of hot water distribution being designed into plumbing of multifamily buildings. The presenters will show some of the wrong ways and defects of the past and what is presently being plumbed in MF buildings. They will demonstrate the most efficient and effective way of distributing hot water to save a great deal of energy, as well as costs of maintenance and repairs that should be unnecessary if plumbed correctly.

Session 7C *Ryman 3*

Energy Requirements of Different Hot Water Circulation Pump Control Strategies

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

Description: Circulation systems for service water heating are installed in buildings where the distance from the water heater to the plumbing fixtures and appliances is large and there is a desire to reduce the waste of water and time waiting for the hot water to arrive. This session will compare the differences in energy consumption based on changing the control strategies of a circulation loop for the service water heating system in a single-family home.

Session 7D *Robertson*

Case Studies for Testing Hot Water Emerging Technologies

Session Moderator: **Joe Shiau,** *Southern California Gas Emerging Technologies Program*

Speakers: **Mary Nones,** *Southern California Gas Engineering Analysis Center*
Residential Recirculation Pump Retrofit
Jorge Gutierrez, *Southern California Gas Engineering Analysis Center*
Water Heater Performance Testing
Joe Shiau, *Southern California Gas Emerging Technologies Program*
Combination Boiler Reset Controls, Prototype Dishwasher Grey Water Recycler

Description: Southern California Gas Company is continuously conducting tests in both labs and field to find new measures. Test results will be presented on residential recirculation pumps retrofit at the farthest sink, water heater performance testing, combination boiler reset controllers, and on a prototype dishwasher grey water recycler.

Thank You Funders!

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