BetterBuilt NW

Mythbusting Hot Water Heating Opportunities

October 5, 2017

Housekeeping

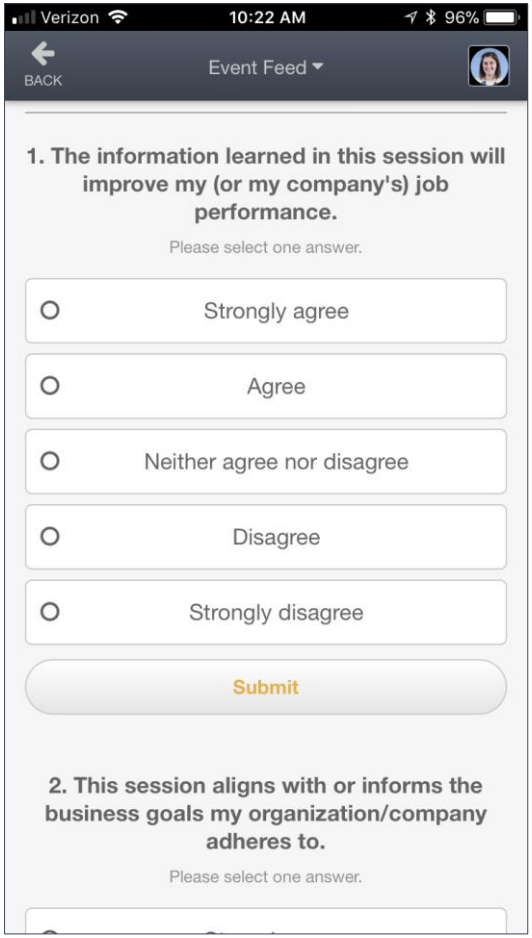
Welcome

- Safety
- Bathrooms
- Cell phones

Session Survey Instructions

At the end of each session, you will be given 5 minutes to complete the session survey.

1. Open the “HEF2017” app
2. Navigate to “Agenda” and select the session
3. Scroll down to “Session Feedback”
4. For each question, select answer and hit “Submit”
5. Show completed survey to BetterBuiltNW rep to earn points
6. Prizes awarded Friday to the top point earners
   - See “Challenge” section in the app for activities
7. Assistance available at the BetterBuiltNW table



Agenda

- Energy & Water Use
- Identify and overcome the common myths about:
  - HPWH
  - CO2 HPWH
  - Plumbing design
  - Solar hot water
- Q & A

What myths have you heard?

- What concerns do you or your clients bring up?
- What technologies have stigma attached regarding performance?
- What do you hope we'll cover?

Water & Energy Use

What do people want

NEVER RUN OUT IN MY SHOWER
= “CONTINOUSNESS”

HOT WATER NOW
= “INSTANTANEOUSNESS”

Wasted Water & Energy

- **20% Distribution Energy Waste**
  - Average 20 percent of energy associated with a hot water delivery system is wasted in distribution losses
- **3,650 Gal. Wasted**
  - Average loss home/yr. waiting for hot water to arrive at the point of use
- **Behavioral Waste**
  - 168 Billion gallons per year

Operating Costs

Table 2. *Relative Costs of Operating Standard and Alternative Distribution Systems*

Standard Distribution System	Water and Wastewater	Natural Gas	Electricity
Total Annual Cost for Hot Water Including Waste	$116	$250	$465
Annual Cost Associated with the Wasted Water	($36)	($84)	($156)
Annual Cost Associated with Intended Water Use	$80	$166	$309
Additional Energy Costs to Operate Recirculation System			
Thermosyphon (24 hours per day, gravity, 5F temperature drop)		$336	$619
Continuous Pump (24 hours per day, 5F temperature drop)		$366	$649
Timer-Controlled Pump (16 hours per day, 5F temperature drop)		$244	$433
Temperature-Controlled Pump (12 hours per day, 5F temperature drop)		$183	$325
Timer and Temperature-Controlled Pump (8 hours per day, 5F temperature drop)		$122	$216
Demand-Controlled Pump (10 minutes per day)		$15	$27
Additional Costs Associated with Residual Wasted Water			
Manifold Systems (approximately 25% reduction)	$27	$63	$117
Heat Trace (approximately 90% reduction)	$4	$284	$284
All 6 Recirculation alternatives (approximately 80% reduction)	$7	$17	$31
Notes: Water and wastewater costs are $0.05 per gallon combined. Natural gas costs are $0.92 per therm. Electricity costs are $0.087 per kWh. Heat trace is only operated with electricity. The costs are the same whether the water heating fuel is natural gas or electricity.			

Source: Gary Klein

Mythbusting Plumbing Layout and Design

Hot Water Performance Metrics

- Temperature
  - ≥ 110F, hot enough to shower in
- Volume-until-hot
  - Goal is no more than 1 cup after opening tap
  - Settle for 2-3 cups, maybe 4
- Time-to-tap
  - Structural waste should be consistent and small
    - < 1 second, possible, but probably energy intensive
    - < 5 seconds, very buildable
    - < 10 seconds, “Acceptable” according to ASPE

Gallons Wasted as a Function of Time and Fixture Flow Rate

(Green < 2 cups), Red >1/2 Gallon)

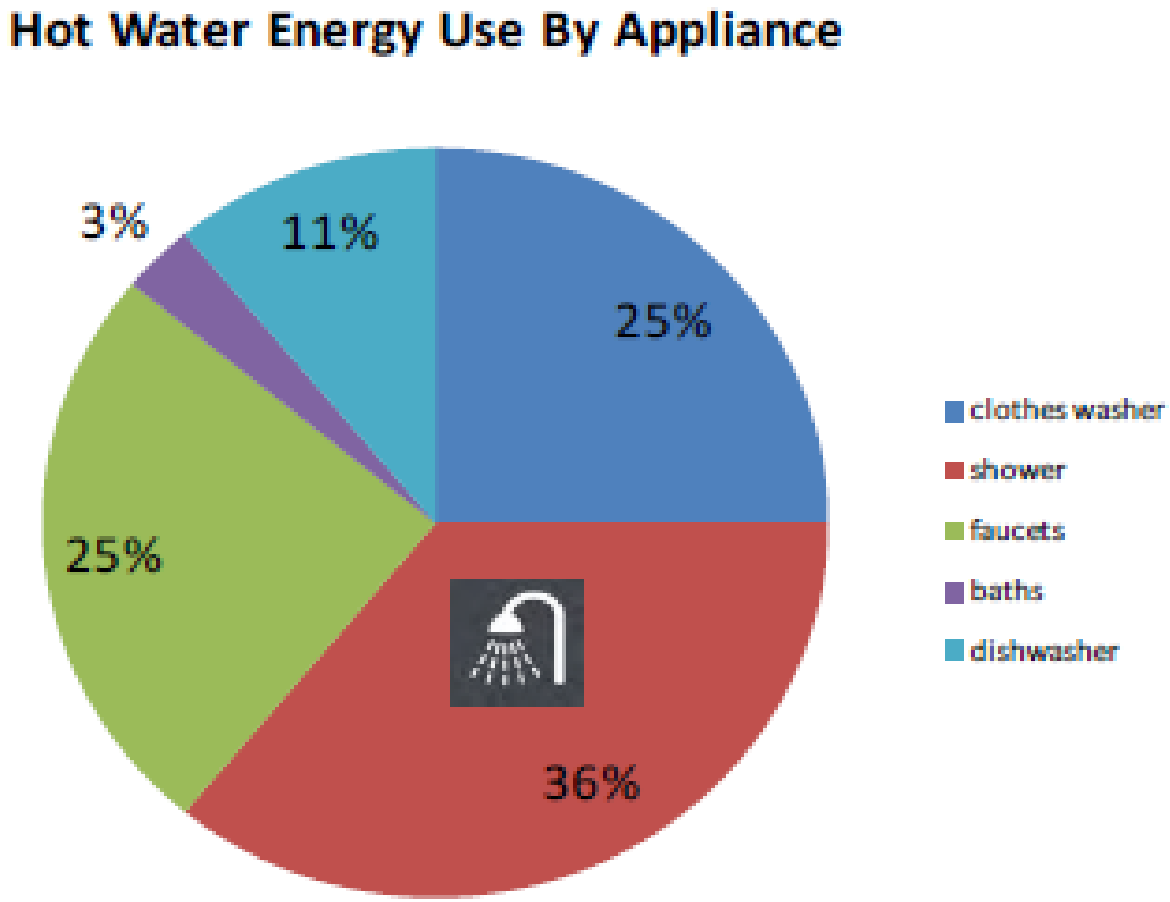
Flow Rate (GPM) \ Time Until Hot Water Arrives (Seconds)	1	2	3	4	5	10	15	20	25	30	35	40	45	50	55	60
0.5	0.01	0.02	0.03	0.03	0.04	0.08	0.13	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50
1	0.02	0.03	0.05	0.07	0.08	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.83	0.92	1.00
1.5	0.03	0.05	0.08	0.10	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.00	1.13	1.25	1.38	1.50
2	0.03	0.07	0.10	0.13	0.17	0.33	0.50	0.67	0.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00
2.5	0.04	0.08	0.13	0.17	0.21	0.42	0.63	0.83	1.04	1.25	1.46	1.67	1.88	2.08	2.29	2.50
3	0.05	0.10	0.15	0.20	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
3.5	0.06	0.12	0.18	0.23	0.29	0.58	0.88	1.17	1.46	1.75	2.04	2.33	2.63	2.92	3.21	3.50
4	0.07	0.13	0.20	0.27	0.33	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00
4.5	0.08	0.15	0.23	0.30	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75	4.13	4.50
5	0.08	0.17	0.25	0.33	0.42	0.83	1.25	1.67	2.08	2.50	2.92	3.33	3.75	4.17	4.58	5.00
5.5	0.09	0.18	0.28	0.37	0.46	0.92	1.38	1.83	2.29	2.75	3.21	3.67	4.13	4.58	5.04	5.50
6	0.10	0.20	0.30	0.40	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00
6.5	0.11	0.22	0.33	0.43	0.54	1.08	1.63	2.17	2.71	3.25	3.79	4.33	4.88	5.42	5.96	6.50
7	0.12	0.23	0.35	0.47	0.58	1.17	1.75	2.33	2.92	3.50	4.08	4.67	5.25	5.83	6.42	7.00
7.5	0.13	0.25	0.38	0.50	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63	6.25	6.88	7.50
8	0.13	0.27	0.40	0.53	0.67	1.33	2.00	2.67	3.33	4.00	4.67	5.33	6.00	6.67	7.33	8.00
8.5	0.14	0.28	0.43	0.57	0.71	1.42	2.13	2.83	3.54	4.25	4.96	5.67	6.38	7.08	7.79	8.50
9	0.15	0.30	0.45	0.60	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50	8.25	9.00
9.5	0.16	0.32	0.48	0.63	0.79	1.58	2.38	3.17	3.96	4.75	5.54	6.33	7.13	7.92	8.71	9.50
10	0.17	0.33	0.50	0.67	0.83	1.67	2.50	3.33	4.17	5.00	5.83	6.67	7.50	8.33	9.17	10.00

1 cup = 8 ounces = 1/16th gallon = 0.0625 gallon

Ideal Design

- Has the smallest volume
  - Keep the volume from the source(s) to the uses small
- Select water heaters matched to uses and patterns
- Minimize pressure drop and optimize velocity in the piping
- Plumbing manifold systems are not recommended

The Power of the Shower



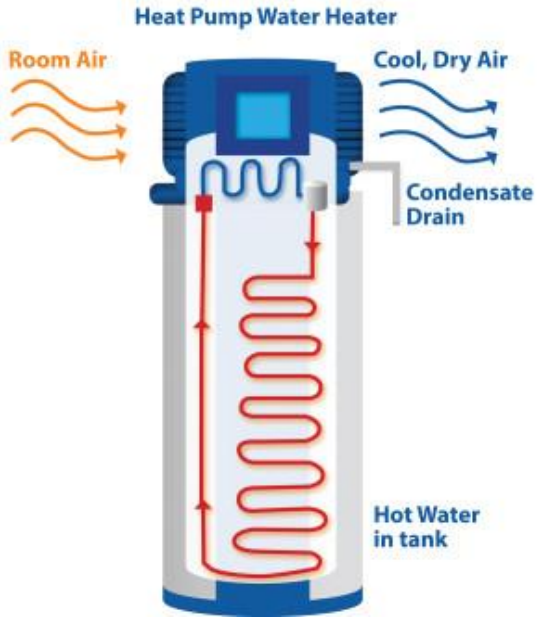
Source: Gary Klein

Water and Energy Saving Devices

- Shower Start
- Tub Diverters
- On Demand Water Recirculation Pumps
- Hot Water Pipe Insulation

Mythbusting HPWHs

Venting



- Venting
  - Comfort
  - Depressurization
  - Heating Interaction

- Resources:
  - Impact of Ducting on Heat Pump Water Heater Space Conditioning
  - RTF HPWH Presentation
  - RTF HPWH Measure Page

Image: http://thesunriseguide.com/energy-efficient-heat-pump-water-heaters/

Efficiencies

Table 2. Performance Characteristics for GE GEH50DFEJSRA

Metric	Measured Value in Hybrid Mode	Measured Value in CCE Mode
First Hour Rating (gal)	66	66
Energy Factor (std. conditions)	3.19	3.19
Energy Factor @ 50°F ambient	1.43	2.27
Northern Climate Energy Factor	2.07	2.54
Tank Heat Loss Rate (Btu/hr° F)	3.28	3.28

Sizing HPWHs

Air-Conditioning, Heating, and Refrigeration Institute

Worksheet for Estimating Peak Hour Demand

- Peak Hour Demand = First Hour Rating
- In this case, three showers are taken each morning and misc. faucet use
- This house would need a unit rated at 70 gallons

Use	Average gallons of hot water per usage		Times used during 1 hour		Gallons used in 1 hour
Shower	20	x		=	
Bath	20	x		=	
Shaving	2	x		=	
Hands & face washing	4	x		=	
Hair shampoo	4	x		=	
Hand dishwashing	4	x		=	
Automatic dishwasher	14	x		=	
Food preparation	5	x		=	
Wringer clothes washer	26	x		=	
Automatic clothes washer	32	x		=	
Total Peak Hour Demand				=	

*The above worksheet assumes no water conservation measures.

Example

3 showers	20	x	3	=	60
1 shave	2	x	1	=	2
1 shampoo	4	x	1	=	4
1 hand dishwashing	4	x	1	=	4
Peak Hour Demand				=	70

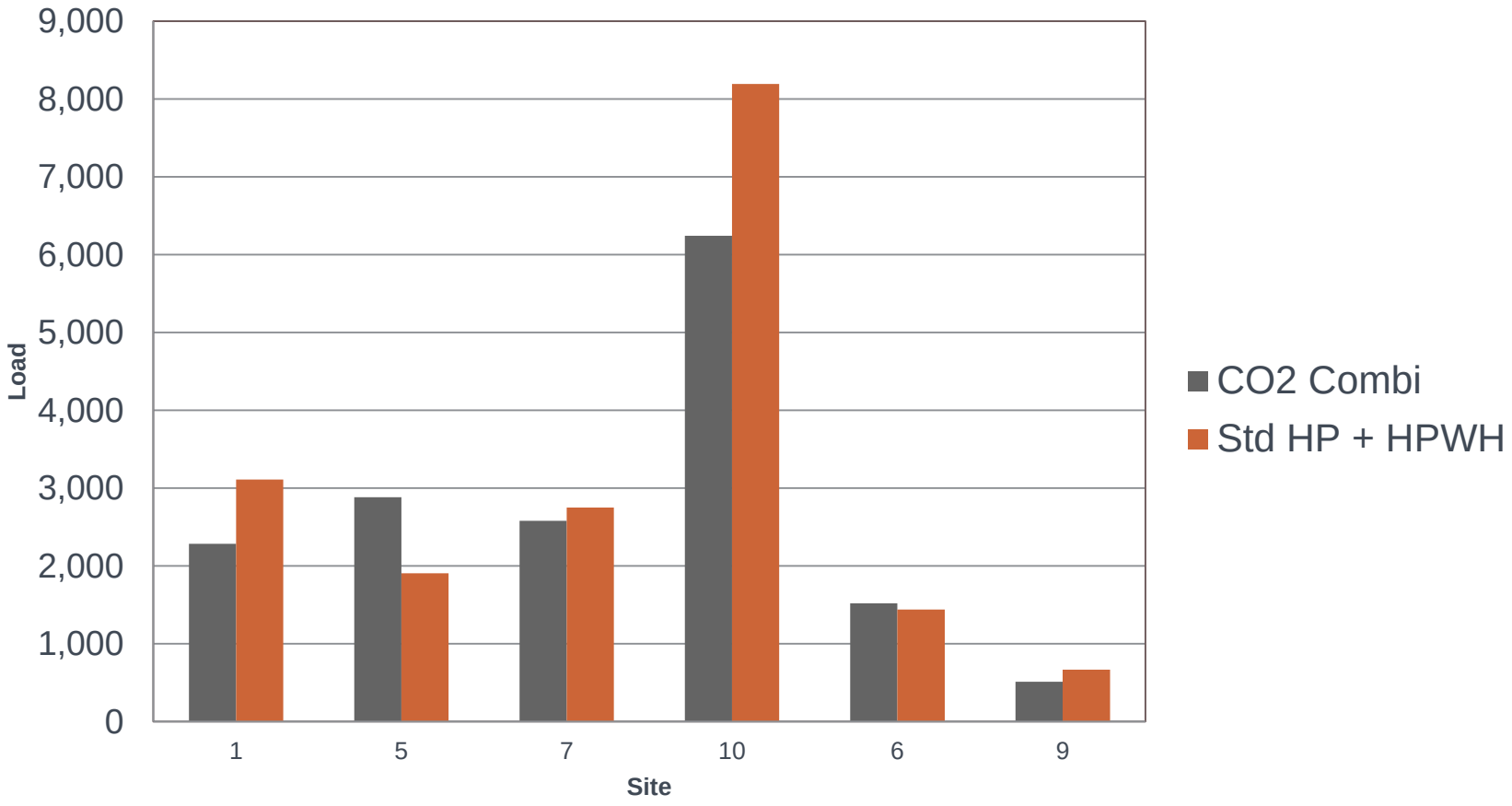
HPWH Benefits vs. Standard Tank

FEATURES	BENEFITS	HPWH	STANDARD TANK
Reliable Hot Water	Hot water when you need it	✓	✓
10 Year Warranty	Peace of mind	✓	
Cuts cost by up to 60%	Save up to $200/year or over $2,000 over 10 years	✓	
Incentive and Tax Credits up to $1,100	Low upgrade costs lead to faster pay back of 2-3 years	✓	
Leak Detection	Avoids a $4,000 water damage invoice	✓	

Mythbusting CO2 HPWHs

Do these work in cold weather?

Measured Combi & Simulated Std HP Annual & Seasonal Loads



Energy Savings / DR

- 40% more efficient than an electric water heater and an electric furnace when configured with heat exchanger in air handler
- 55% more efficient than electric systems when configured with a radiant floor system
- Capable of demand response for space heating provided domestic hot water use is average or below normal
- PNNL final report published September 29, 2017
  - See report here

Solar in the Pacific NW, seriously?

Benefits of Solar Hot Water

- Low Cost Panels
- UV Enhanced
- Silicon Fluid
- Proven Technology
- ROI
  - Similar to Solar PV
- Builders Embracing


5 Questions for You

Questions for YOU!

- What are myths you've heard that we did not identify?
- What have you seen as a solution with HPWHs?
- What have you seen as a solution or innovation with plumbing design, layout, and install?
- What have you seen as a solution with drain water recovery or other technology not mentioned?
- What are some excellent solutions, current or coming, with gas water heat?


Q & A

Thank you

Mark Jerome

info@betterbuiltnw.com