Getting into Hot Water: Heat Pump Water Heaters Put Builders on Target for Reducing the Single Largest Load in New Homes

Geoff Wickes
Sr. Product Manager
Emerging Technology
Outline

- HPWH Magnitude of savings
  - Specifications
- Who makes the major brands?
- Installation considerations (the water heater as a system)
  - Size
  - Location
  - Plumbing layout
  - Circulator pumps and drain water recovery
- Emerging Trends:
  - Connected home
  - Demand Response (CTA 2045)
  - Split Systems
  - New Products Coming
- Value Proposition to Customer:
  - Total Cost of ownership
Experience in the Room

Which best describes your business?
- Builders
- Developers
- HVAC Installers
- Plumbers
- Home Performance Contractors

How many have sold Heat Pump Water Heaters (HPWHs)?
- 1 year or more
- 2-3 or more
- 5 years or more
How many heat pumps are in the typical home?
Old Standard vs. HPWH – The New Standard

All Three of the major OEMs are making great products-
AO Smith
Rheem
Bradford White
Consumer Profile
Accounts for 18% of energy load

BUYERS ARE EARLY ADOPTERS

- 40% heat their homes with a ductless heat pump
- 66% earn more than $60k per year (on average)
- 63% have a bachelor’s degree or higher
- 50% or more perform self-installs
- 99% own their home
Explaining the Technology Features

Heat pump technology:

- Heat is moved from the surrounding air to the water in the tank
- Transferring heat allows for a 60% less energy use
- Most have leak protection
- 10 year warranty
Heat pump technology:
2 to 4 times more efficient than electric resistance

Moves heat (like a fridge or A/C in reverse) instead of generating it (like electric resistance water heaters)
# HPWH Benefits vs. a Standard Tank

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>BENEFITS</th>
<th>HPWH</th>
<th>STANDARD TANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliable Hot Water</td>
<td>Hot water when you need it</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>10 Year Warranty</td>
<td>Peace of mind</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Cuts cost by up to 60%</td>
<td>Save up to $400/year or over $4,000 over 10 years</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Incentive and Tax Credits up to $1,100</td>
<td>Low upgrade costs lead to faster pay back of 2-3 years</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Leak Detection</td>
<td>Avoids a $4,000 water damage invoice</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
AeroTherm vs. Standard Electric

The first water heater that pays for itself!

AeroTherm Hybrid Electric water Heater

EF=.95

EF=3.39

Estimated yearly operating cost*

$555

- $155

$400

Annual Savings

Standard Gas

$264

- $155

$109

*Estimated yearly operating cost: AeroTherm Hybrid Electric water heater has an estimated yearly operating cost of $555, with a $155 savings compared to the standard electric water heater. The standard gas water heater has an estimated yearly operating cost of $264, with a $155 savings compared to the AeroTherm Hybrid Electric water heater.

Made in America

Bradford White Water Heaters
**Installation Considerations**

**Space**
- 700 cubic ft. of space or ducting
- Clearance requirements
  - Piping
  - Anode rod service
  - Air filter replacement

**Condensate**
- Remove condensate
  - Pump or sloped system
  - Terminate into an existing drain or outside
    - Condensate is non-toxic

**Ducting**
- Confined spaces or to remove cold air
- Mounting – vibration isolation recommended
Ideal Locations*

1. Insulated garage
2. Attic*
3. Uninsulated garage*
4. Laundry room
5. Heated basement
6. Basement mechanical room (staircase from hell)
7. Dugout crawl space
8. Closet built around existing water heater
9. Unheated basement
10. Low boy under the sink

* Climate dependent
Training Example: How would you respond?

- I’m not sure these are Reliable... 10 year warranty
- It’s too expensive...
  - 60% savings and incentives
- The technology is too new...
  - Heat pump technology has been around for over 60 years
- I don’t want to run out of hot water...
- Same delivery as a standard tank
### Value Proposition to Installers and Builders

#### Installer Value (approximate)

<table>
<thead>
<tr>
<th></th>
<th>Standard Tank</th>
<th>HPWH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross profit per water heater</td>
<td>$550</td>
<td>$700 - $1,300</td>
</tr>
<tr>
<td>Gross profit for 24 units / year</td>
<td>$13,200</td>
<td>$16,800 - $31,200</td>
</tr>
</tbody>
</table>

**Includes local average incentives**

#### Large Scale Builder Value (approximate)

<table>
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<th></th>
<th>Standard Tank</th>
<th>HPWH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross profit per water heater</td>
<td>$80</td>
<td>$200 - $400</td>
</tr>
<tr>
<td>Gross profit for 600 units / year</td>
<td>$48,000</td>
<td>$120,000 - $240,000</td>
</tr>
</tbody>
</table>

**30%-140% more than standard tank**

**150%+ more than standard tank**
States with Large Target Markets and Significant Incentive Coverage

► Replacement & New Construction Markets
  - SE: North Carolina, South Carolina, Georgia
  - NW: Washington, Oregon
  - MW: Ohio
  - SW: Arizona

► Replacement Market
  - Mid-Atlantic: Pennsylvania, Maryland, DC

► New Construction Market
  - California
  - Florida
HPWH Benefits to the Customer

- **Up to $400 / annual savings**
  Reduced total cost of ownership

- **Immediate savings**
  through incentives

- **Peace of mind** through warranty

- **Same reliable hot water delivery**

- Avoids **average $4,000** water damage bill through leak detection
Water heating as a system for maximum appreciation

- Proper sizing of tank
- Ideal location of tanks
- Plumbing considerations
  - Core location
  - Trunk, branch and twig
- Circulator considerations
  - Timer minimum
  - Learning controls
  - On demand ideal
- Fixtures
  - Low Flow
  - Temperature activated
- Waste heat recovery
Example of Recirculation System
On Demand System

Act D’mand System
Plumbing Distance Matters: Lessons learned?

Plumbing layout and pumps greatly impact delivered hot water times.

Homeowner expectations in high efficiency homes are high.

Homeowner education is key to meeting both expectations and performance.

HOW LONG SHOULD WE WAIT?

<table>
<thead>
<tr>
<th>Volume in the Pipe (ounces)</th>
<th>Minimum Time-to-Tap (seconds) at Selected Flow Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.25 gpm</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>16</td>
<td>30</td>
</tr>
<tr>
<td>24</td>
<td>45</td>
</tr>
<tr>
<td>32</td>
<td>60</td>
</tr>
<tr>
<td>64</td>
<td>120</td>
</tr>
<tr>
<td>128</td>
<td>240</td>
</tr>
</tbody>
</table>

ASPE Time-to-Tap Performance Criteria

- Acceptable Performance: 1 – 10 seconds
- Marginal Performance: 11 – 30 seconds
- Unacceptable Performance: 31+ seconds

Emerging Trends

- Connected home
- Demand response (CTA 2045)
- Split systems
- Sustainable communities
  - Renewable integration
  - Gas to electric or all electric homes
- New Products
Connected Home Core Values

- Device Control
- Security
- Energy Management
- Maintenance

Image source: Homeplug.org
Demand Management Requirements

- Utility’s Perspective
  1. Dispatch-able (aka reliable)
  2. Measureable demand reduction
  3. Low cost
  4. Can be built incrementally

- Customer Perspective
  5. Does not impact benefits provided from connected device (water is hot, room temperature is good . . .)
  6. No effort required
  7. What’s in it for me? ($, services, feel good, mgmt.)
CTA 2045

- Open Source Standard for demand management
- 3 Defined Layers

*CTA = Consumer Electronics Association
CTA 2045

- Open Source Standard for demand management
- 3 Defined Layers

CTA = Consumer Electronics Association
Water Heater Example

The Socket Interface is the Standard

CEA

Consumer Electronics Association
Split Systems – Great COP more coming

**Benefits**
- COP of over 4
- Operate at lower temperatures
- High capacity
Sustainable Communities

• Growing number of communities across the US
• Aggressive CO2 goals
• See Heat Pump technologies as prime partners to meet goals
• Integrating more renewables
• Electronification ~ Gas to Electric conversions
• All electric homes ~ moving to code reqd.
The Age of Renewable Generation

Three Solutions

1. Turn off PV or Wind (wasteful)
2. Battery Storage (expensive, but essential)
3. Flexible Loads (use renewable electricity when surplus and delay use during peak and extreme ramp rate periods)

Image source: California ISO
As CA grid gets cleaner, HPWH offer pathway to very low-GHG hot water

* Assumes:
  1) Fugitive methane emissions not included
  2) 45%-efficiency combined cycle gas plant (build margin)
**Store Excess Energy**

- Solar & Wind produce energy in limited hours
- Output varies
- Energy with no place to go!

New designs and products coming

- Split systems for challenging installs
- Higher tank temperatures with mixing valves
- Smaller tank heat pumps
- PV direct powered systems
- 120 volt system
- Multi-family solutions
- Change in refrigerants
- Off shore suppliers
Get Ready

- Source product and pricing at a local distributor
- Install water heaters as systems
- Gather local rebate details
- Ensure all staff are ready to talk about the benefits and details of HPWHs
- Print best practices guides for installations and homeowner guides for customer education
- Get educated by your manufacturer if you haven’t already
Resources to Get You Started

Installer Resources

• [Best Practices Installation Guide](#)
• [Homeowner Quick Reference Guide](#)
• [Hot Water Solutions Image Library](#)
• [Sales sheet](#)
• [Advanced Water Heater Specification](#)
• [Qualified Products List](#)
• [Incentive listings](#)

• Program Website: [http://hotwatersolutionsnw.org/partners/resources](http://hotwatersolutionsnw.org/partners/resources)