

# Actual Savings and Performance of Gas Tankless Water Heaters

LV-11-001

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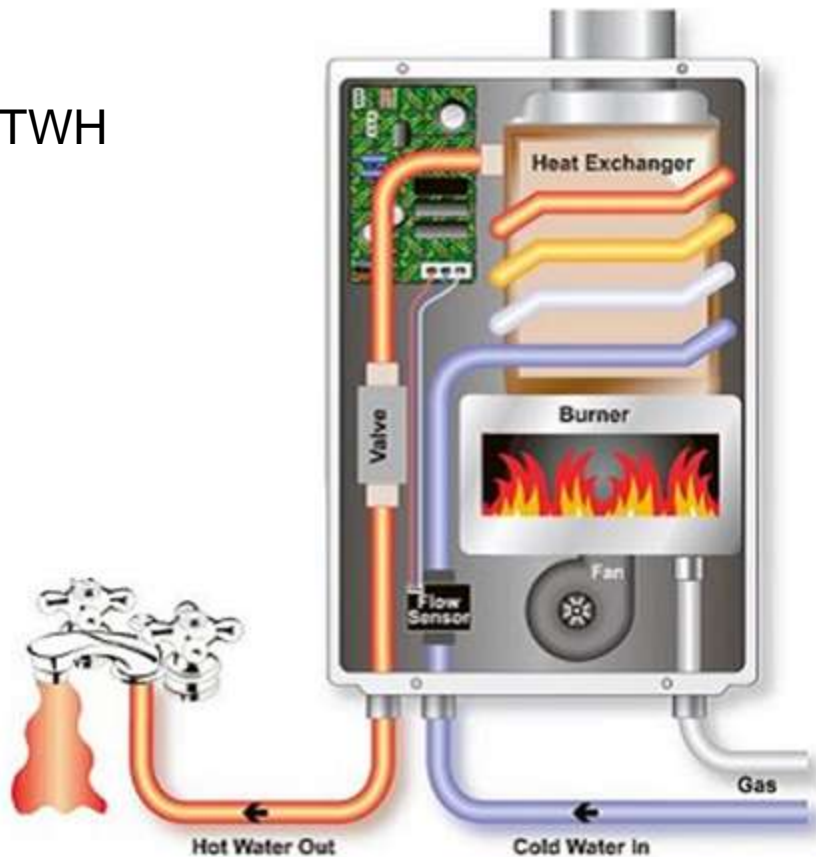
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Center for Energy and Environment  
Minnesota Office of Energy Security

# Field Study Overview

- Objectives
  - To determine installed performance of tankless and storage water heaters
  - To monitor hot water consumption behavior
- Methodology
  - 10 sites
  - 24 water heaters
    - 8 storage water heaters (StWH): 40 gal. 40,000 Btu/hr, natural draft
    - 9 non-condensing tankless water heaters (NTWHs)
    - 7 condensing tankless water heaters (CTWHs)
  - 4 week alternating mode test
  - Extensive data logging
  - Homeowner Surveys
  - Lab test presented in LV-11-003

# How Do Water Heaters Work?

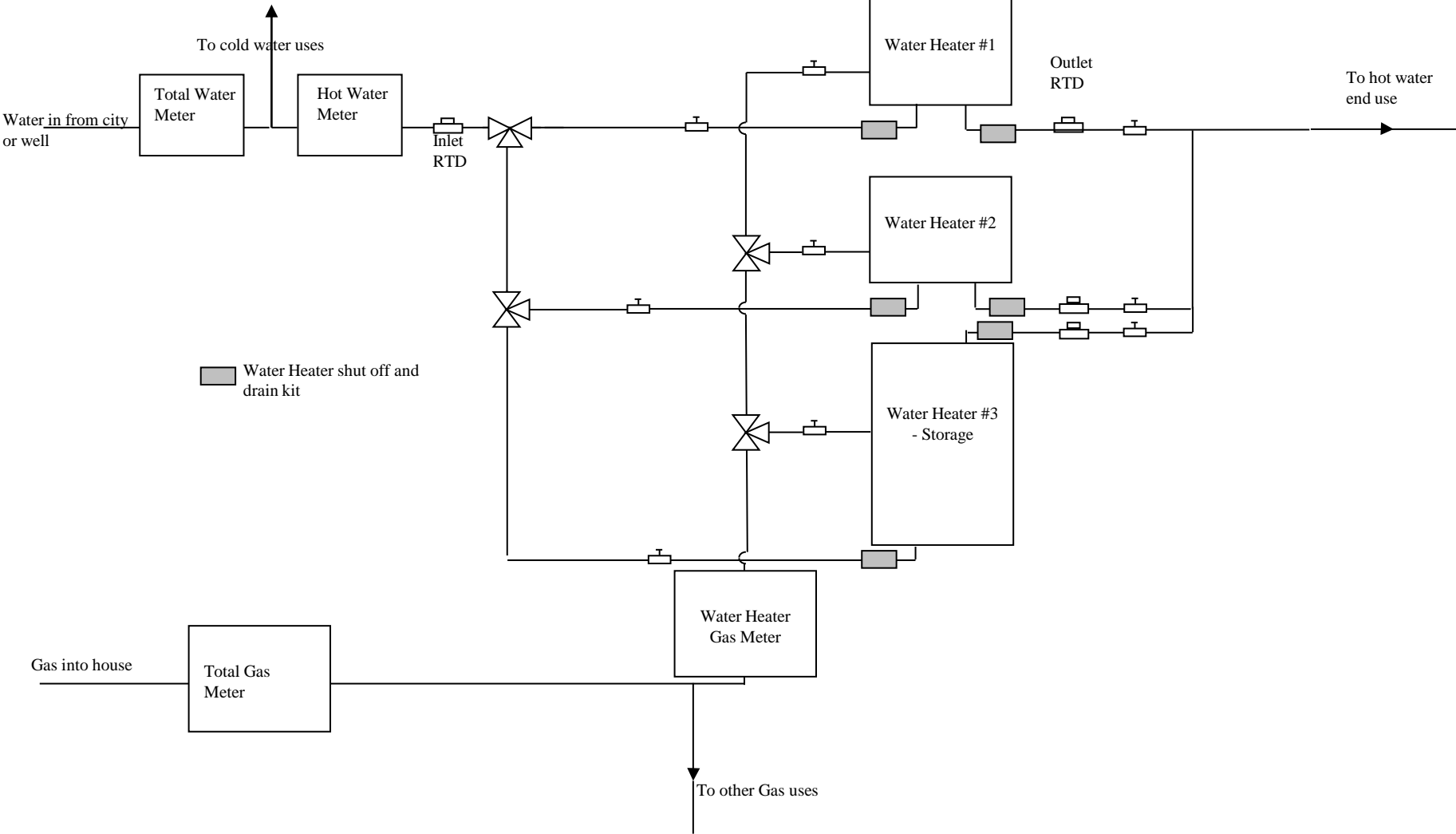
TWH



StWH



# Site Layout

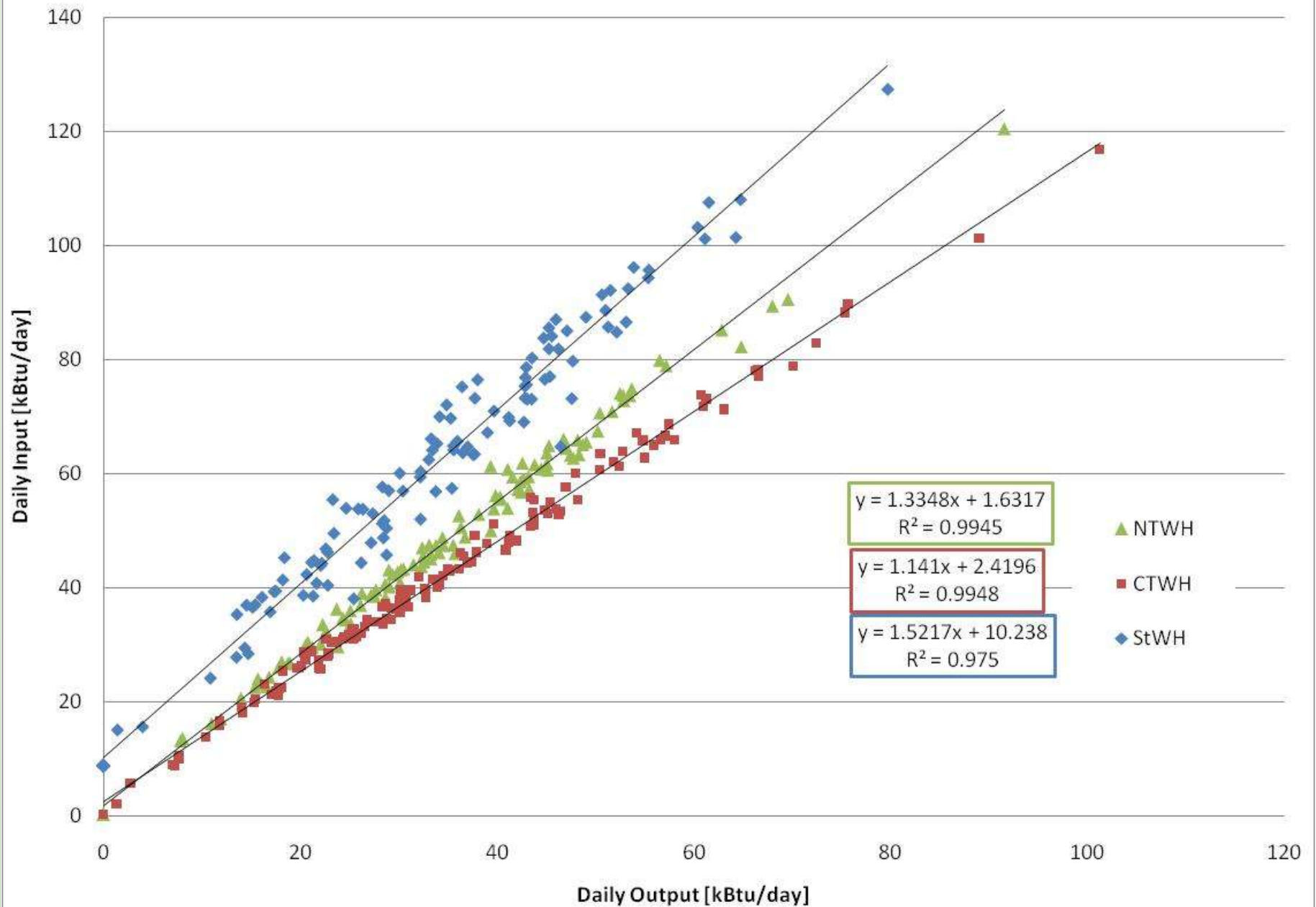




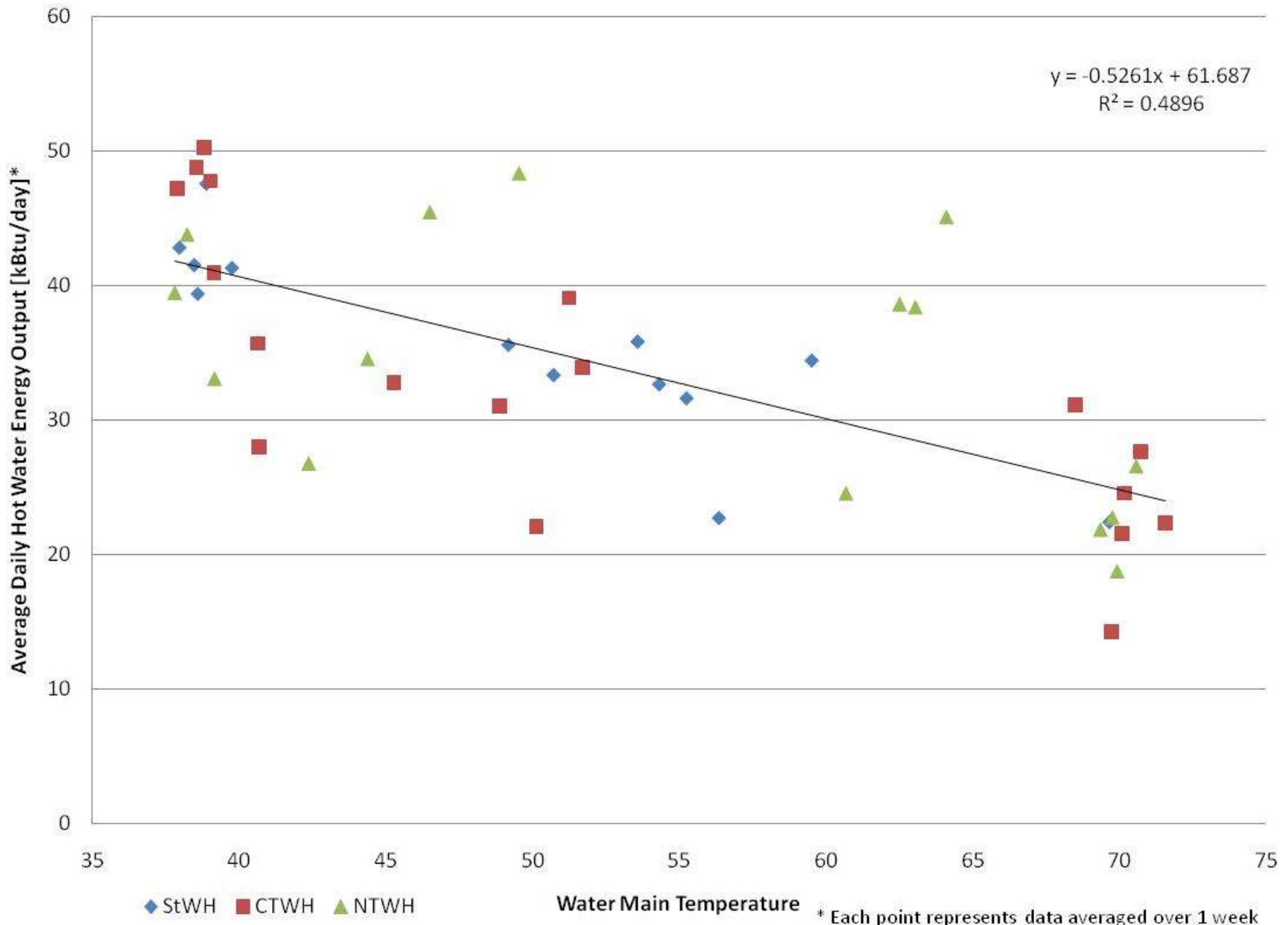
CTWH

NTWH

# Daily Input Output Modeling

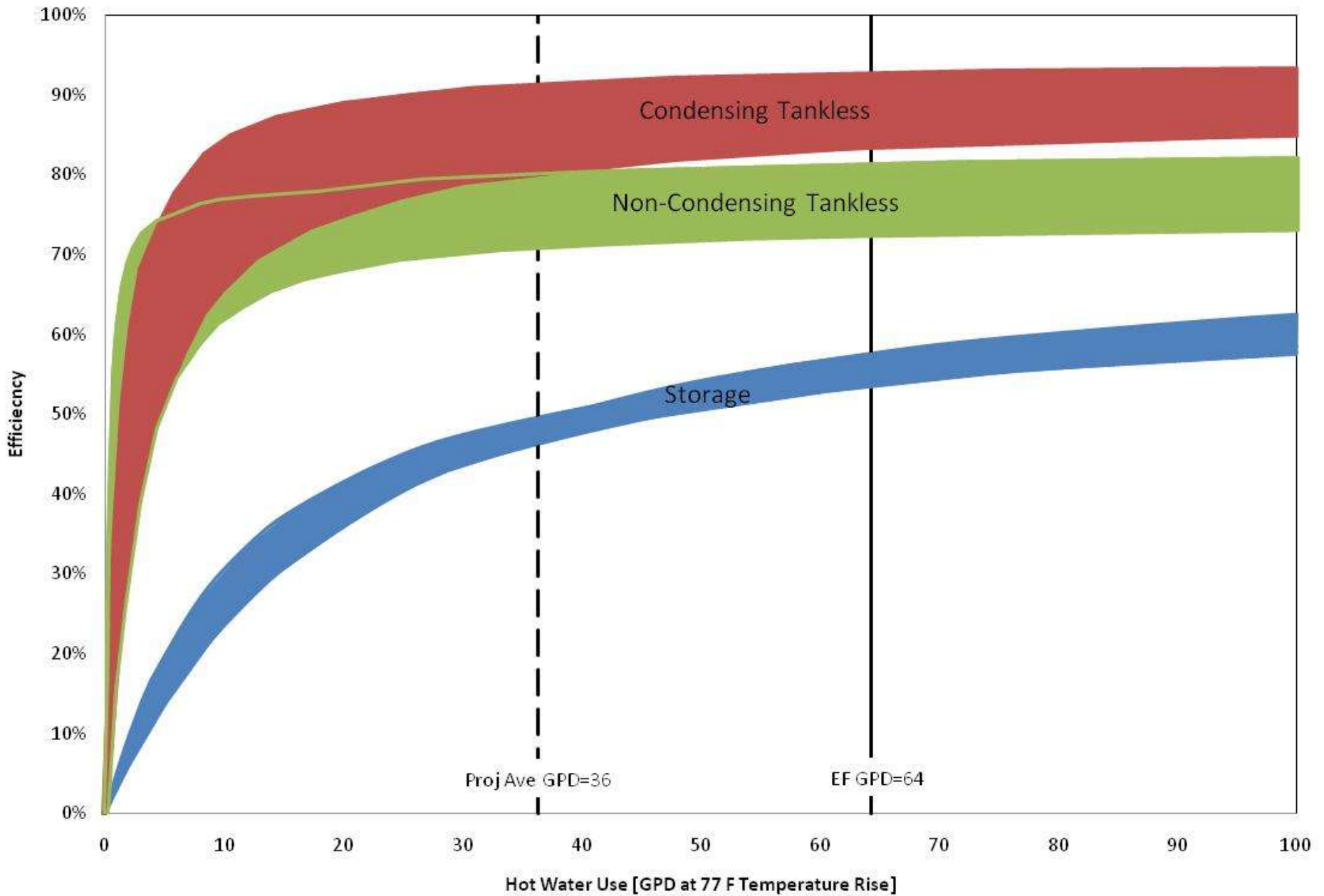


# Seasonality of Natural Gas Consumption



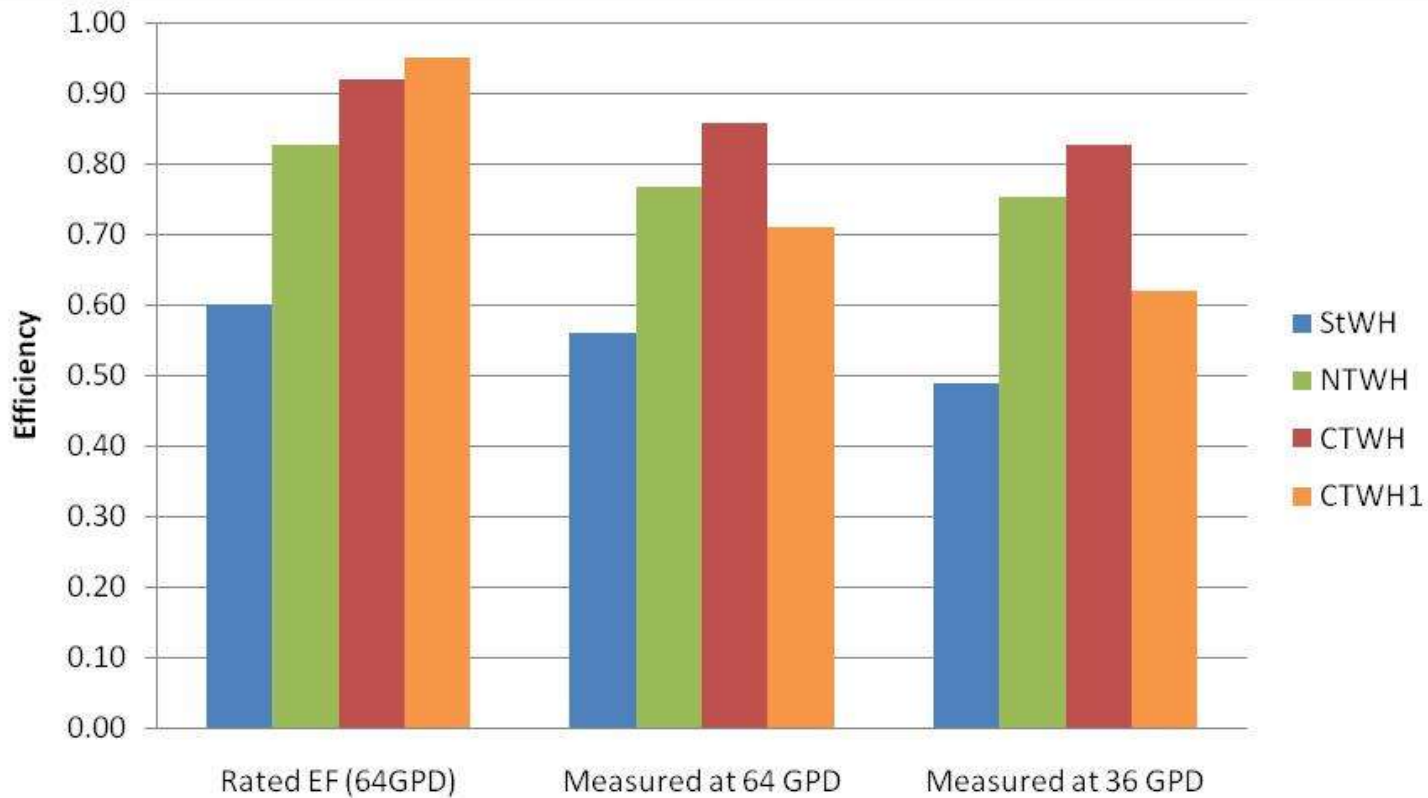


# Daily Installed Efficiencies for Residential Water Heaters





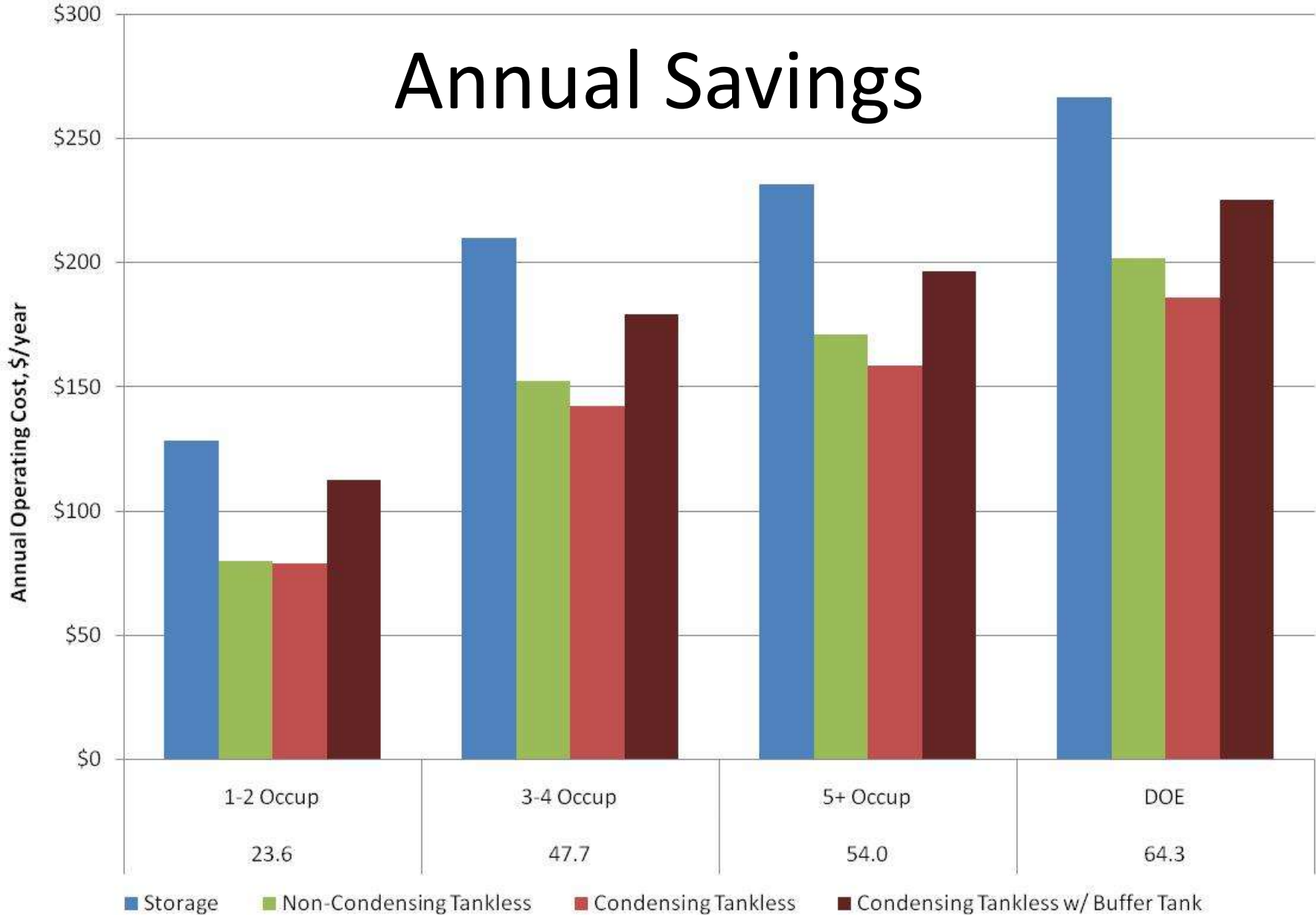
# Rated vs Measured Daily Efficiencies



|       | <b>EF – Measured Eff</b> |           |
|-------|--------------------------|-----------|
|       | <b>EF</b>                |           |
|       | at 64 GPD                | at 36 GPD |
| StWH  | 7%                       | 18%       |
| NTWH  | 7%                       | 9%        |
| CTWH  | 7%                       | 10%       |
| CTWH1 | 25%                      | 35%       |

\*CTWH1 has a 0.5 gallon buffer tank

# Annual Savings



|       | Natural Gas Consumption, therms/yr |         |        |       |
|-------|------------------------------------|---------|--------|-------|
|       | 1-2 ppl                            | 3-4 ppl | 5+ ppl | EF    |
| StWH  | 128.30                             | 210.2   | 231.4  | 266.5 |
| NTWH  | 73.17                              | 144.6   | 163.1  | 193.8 |
| CTWH  | 67.76                              | 130.3   | 146.6  | 173.4 |
| CTWH1 | 98.83                              | 163.9   | 180.8  | 208.6 |

|       | Savings over StWH, \$/yr (%) |            |            |            |
|-------|------------------------------|------------|------------|------------|
|       | 1-2 ppl                      | 3-4 ppl    | 5+ ppl     | EF         |
| NTWH  | \$48 (38%)                   | \$58 (28%) | \$61 (26%) | \$65(24%)  |
| CTWH  | \$49 (38%)                   | \$68 (32%) | \$73 (31%) | \$80 (30%) |
| CTWH1 | \$16 (12%)                   | \$31 (15%) | \$35 (15%) | \$41 (15%) |


# Hot Water Usage

- No statistically significant difference in hot water usage between TWHs and StWH at any site.
- But, there was a difference in draw pattern
  - On average, TWH draws were longer and at a higher flow rate than StWH draws, but there were fewer of them per day

|      | Draws   | Length  | Volume  | Flow Rate |
|------|---------|---------|---------|-----------|
|      | per day | seconds | gallons | gpm       |
| StWH | 28.3    | 58.0    | 1.2     | 1.3       |
| TWH  | 22.5    | 72.8    | 1.4     | 1.4       |

# Home Owner Surveys

Site Average

Standard Tank 

Non - Condensing Tankless 

Condensing Tankless 

Delay until hot water  
arrives at fixtures

Outer circle represents definitely would  
buy this product with decreasing desire  
to buy towards the center

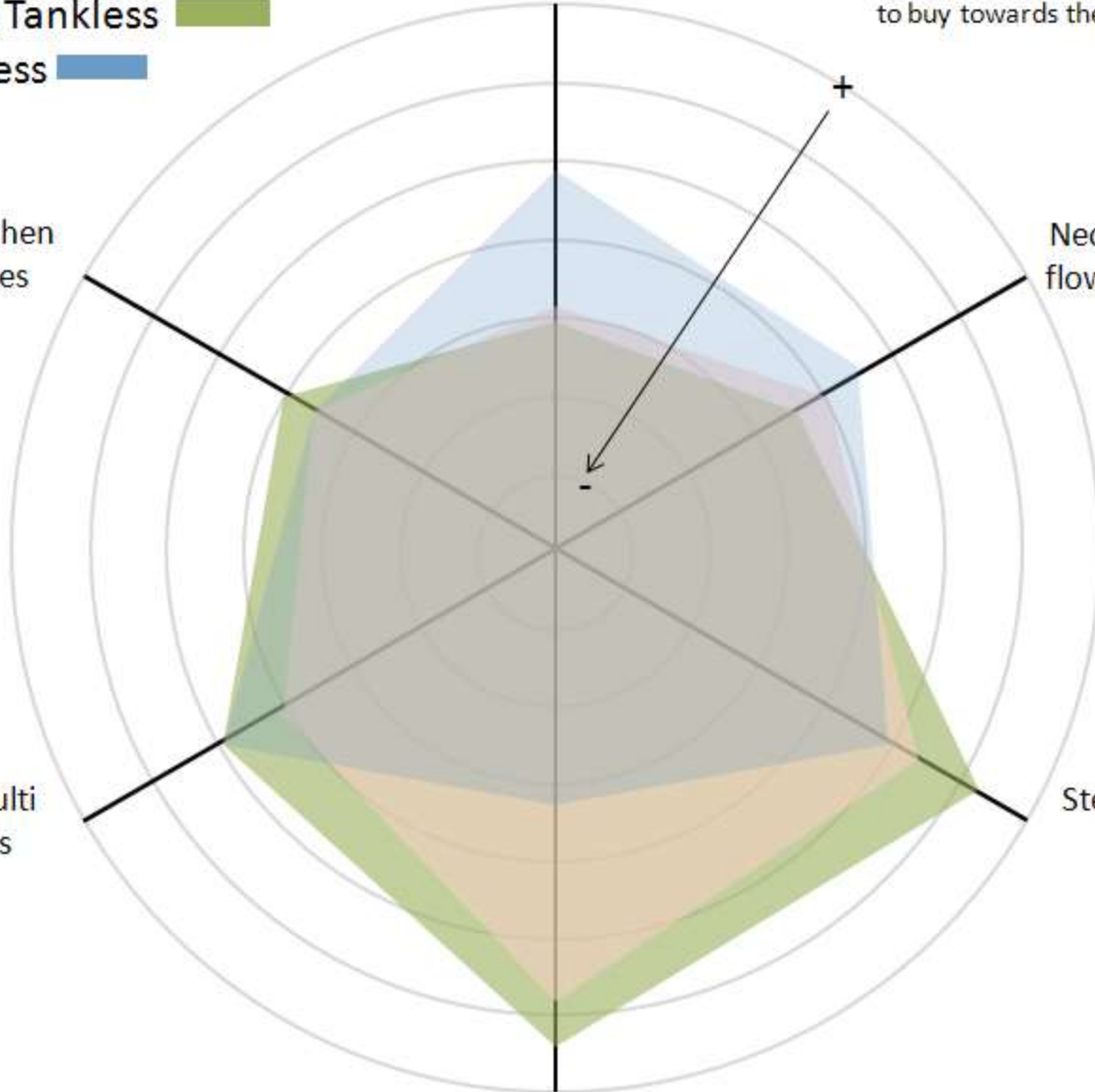
Flow Rate reduction when  
using multi simuilt uses

Necessity to increase  
flow when low flow is  
desired

Steady temp for multi  
simultaneous uses

Steady temp for a single  
use

Continuous production of hot water  
w/out running out



# Conclusions

- Measured efficiencies of StWH and TWHs averaged 18% and 9% less than their EF rating, respectively.
- TWHs save 30-50% of WH energy costs but high installed costs make for long paybacks.
- TWHs were rated more likely to be purchased for “endless” hot water capacity and consistent water temperature, but less likely for delay time and performance at low flows.