Actual Savings and Performance of Gas Tankless Water Heaters

LV-11-001

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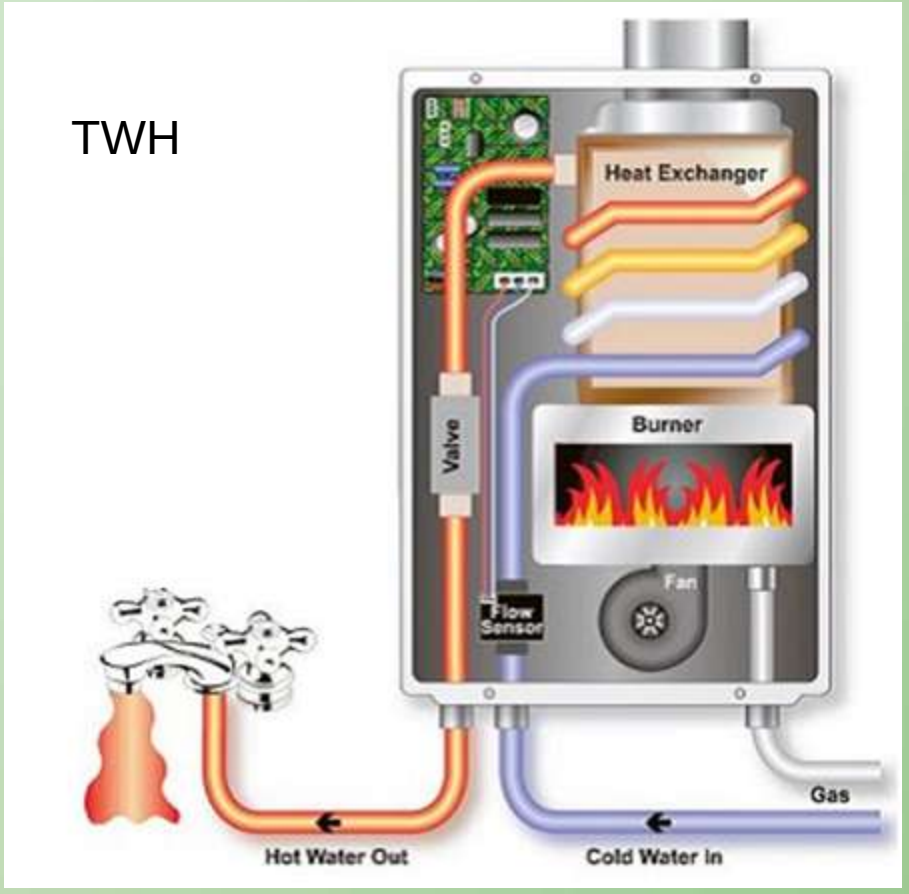
Zero ENERGY DESIGN
A SAFE BET

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

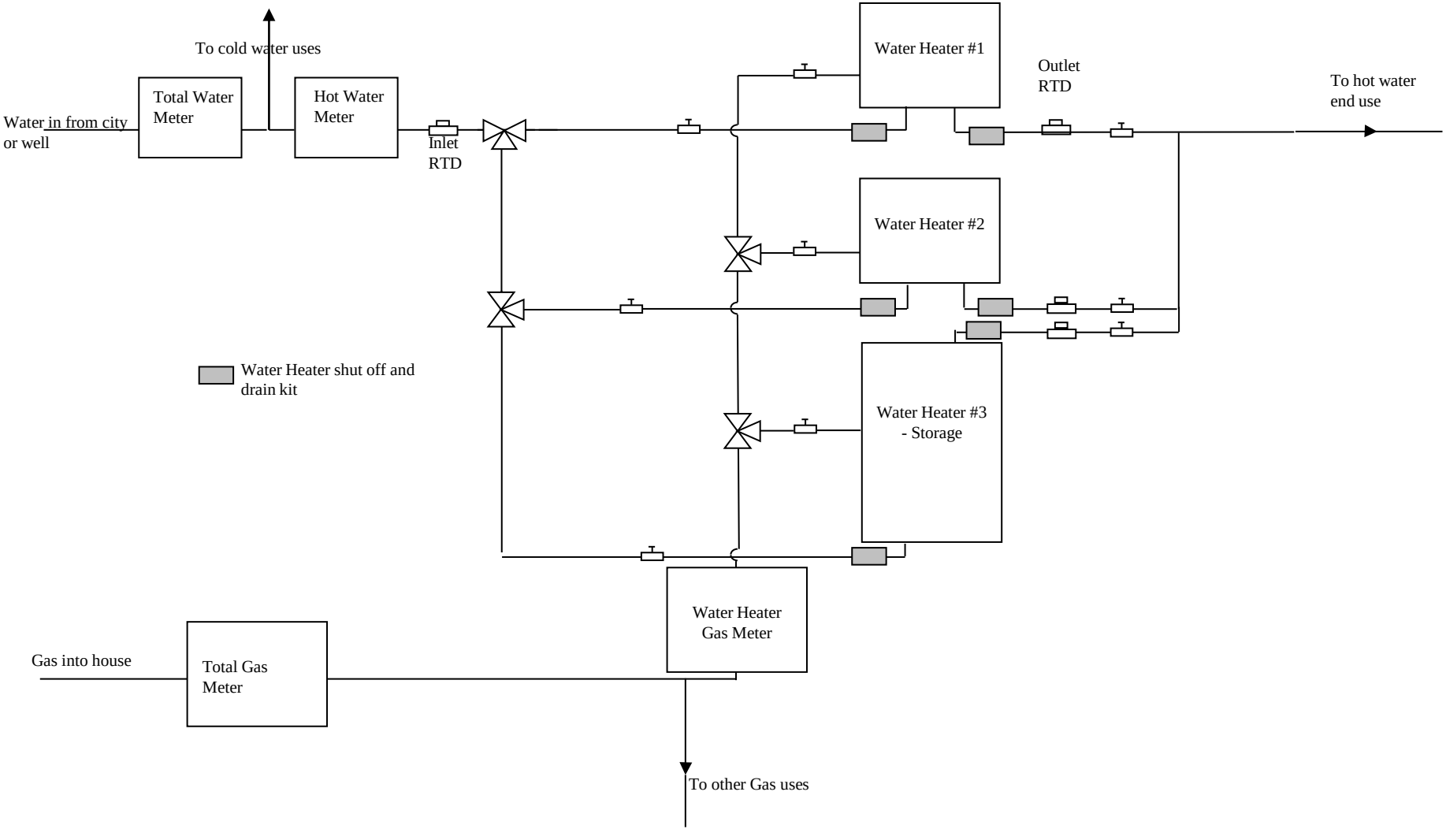
How Do Water Heaters Work?

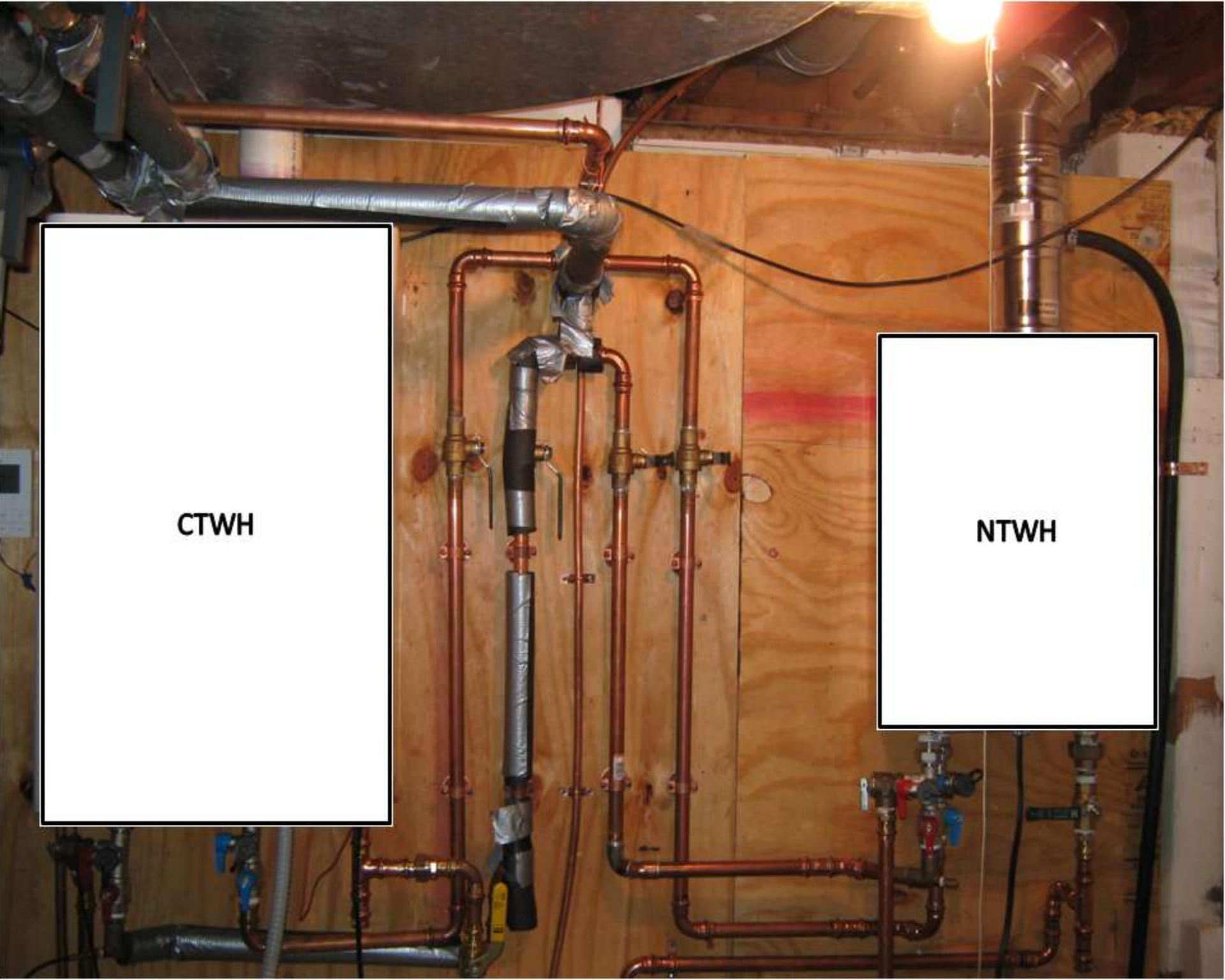
TWH



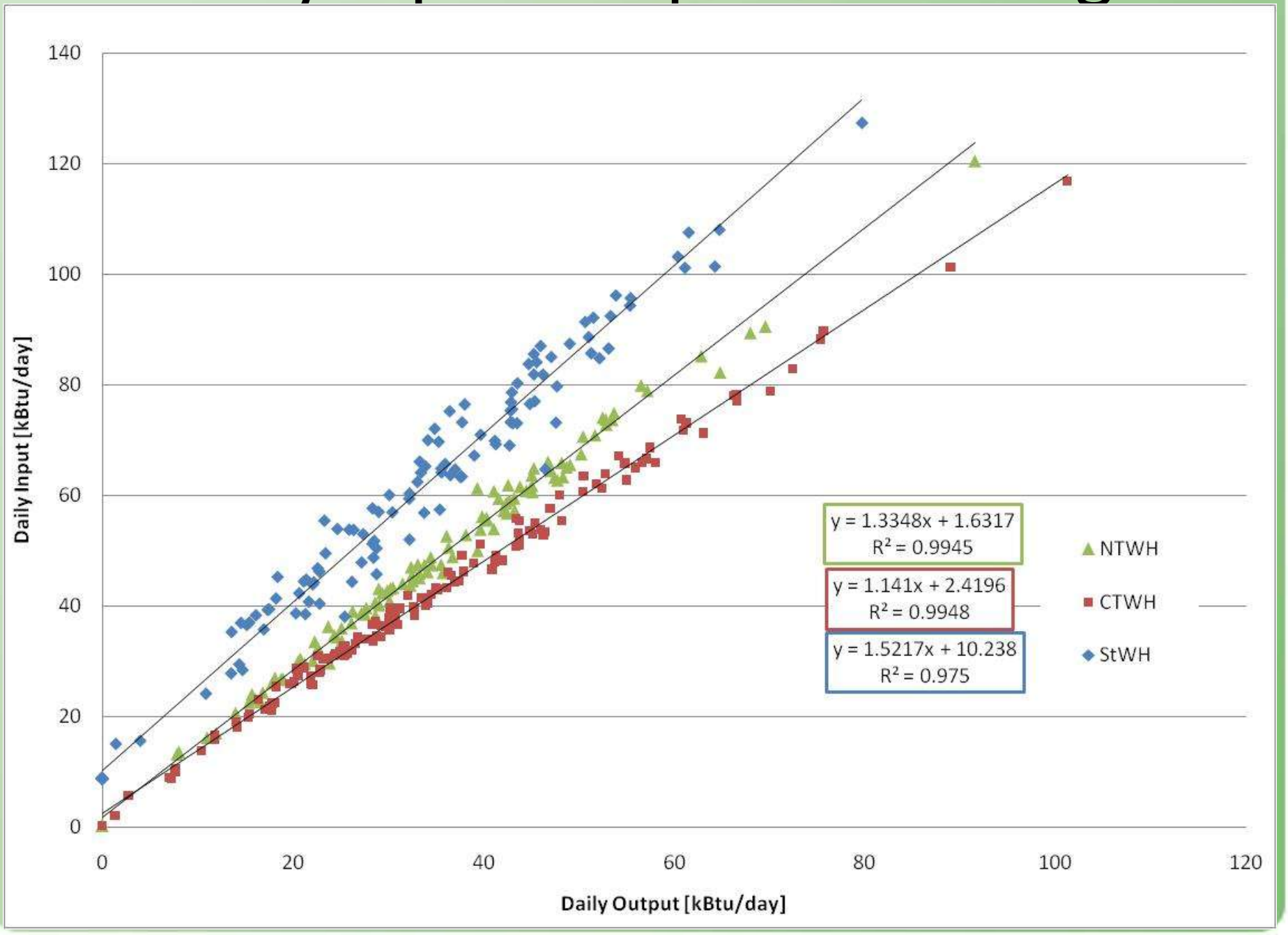
StWH

Site Layout

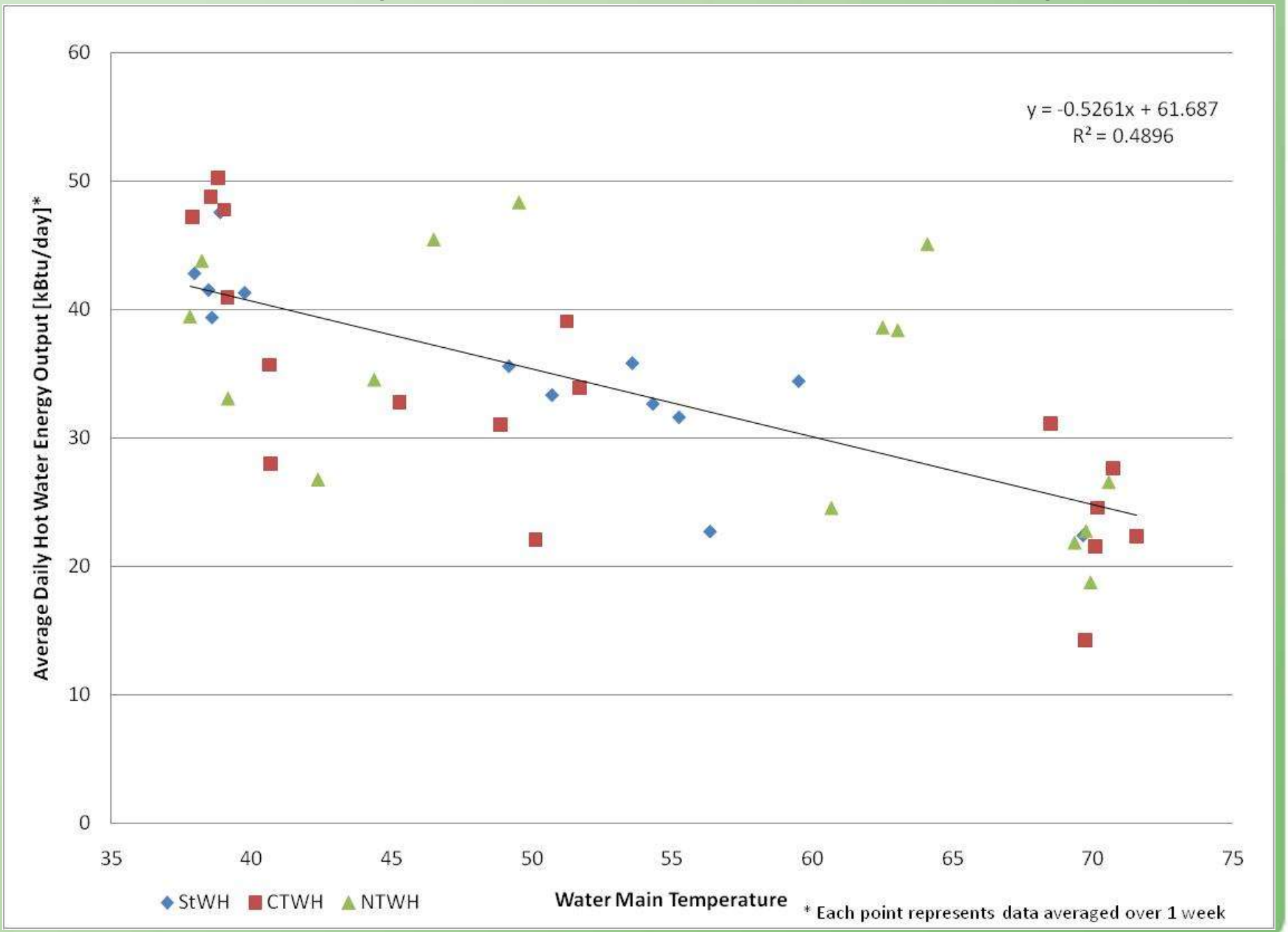

To cold water uses
Water in from city or well
Total Water Meter
Hot Water Meter
Inlet RTD
Water Heater #1
Outlet RTD
To hot water end use
Water Heater #2
Water Heater shut off and drain kit
Water Heater #3 - Storage
Water Heater Gas Meter
Gas into house
Total Gas Meter
To other Gas uses


CTWH
NTWH

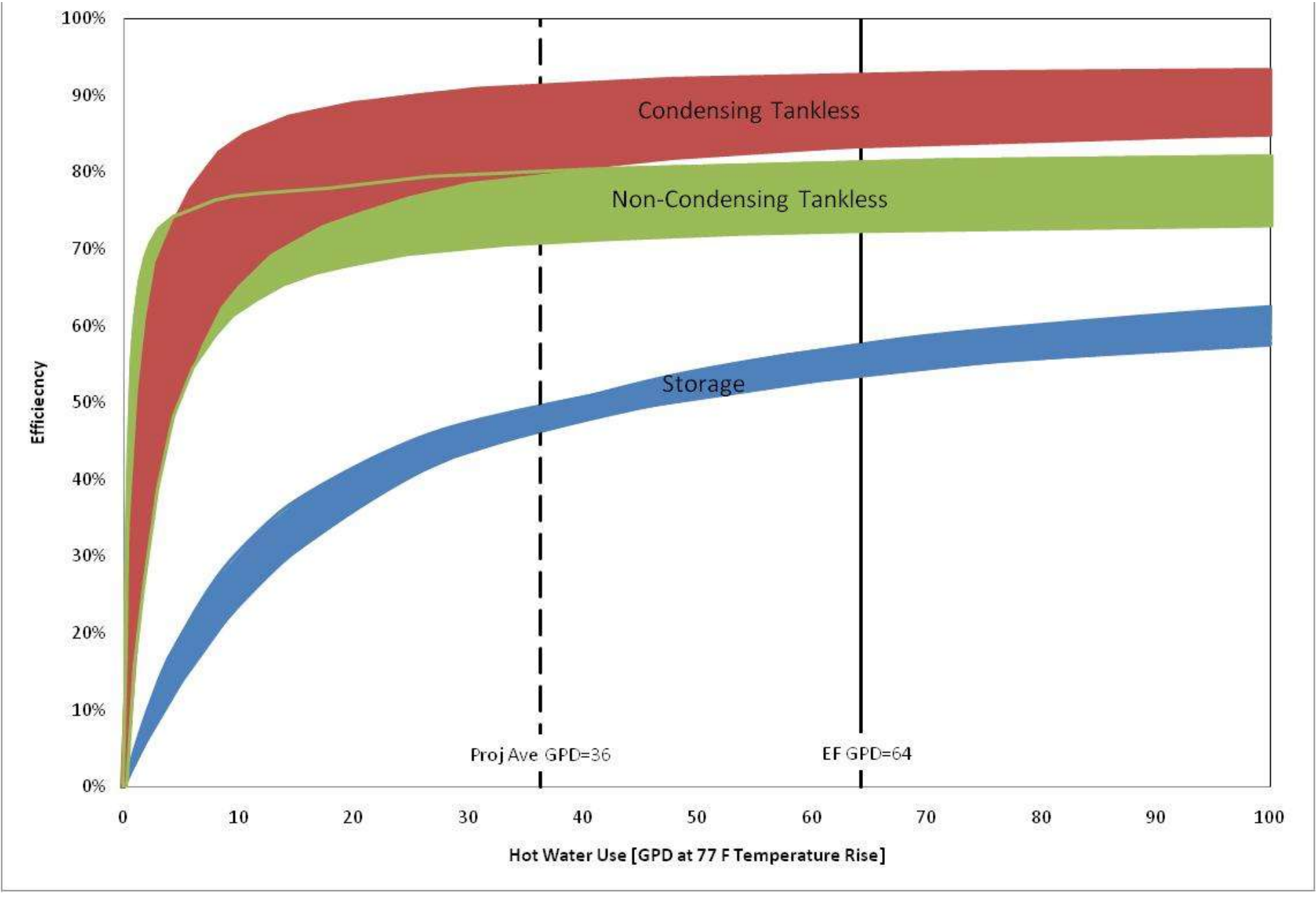
Daily Input Output Modeling



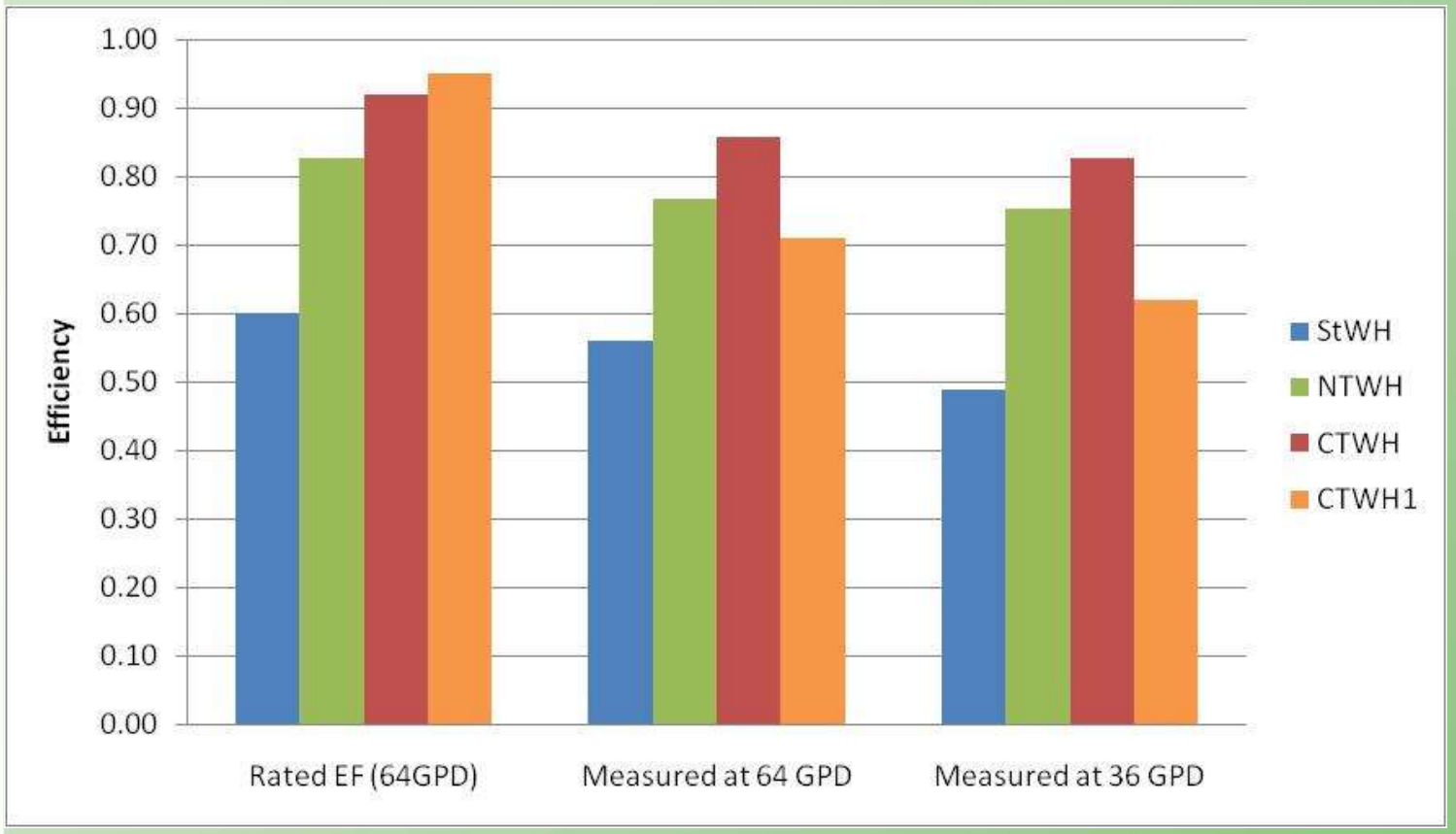
Seasonality of Natural Gas Consumption



Daily Installed Efficiencies for Residential Water Heaters



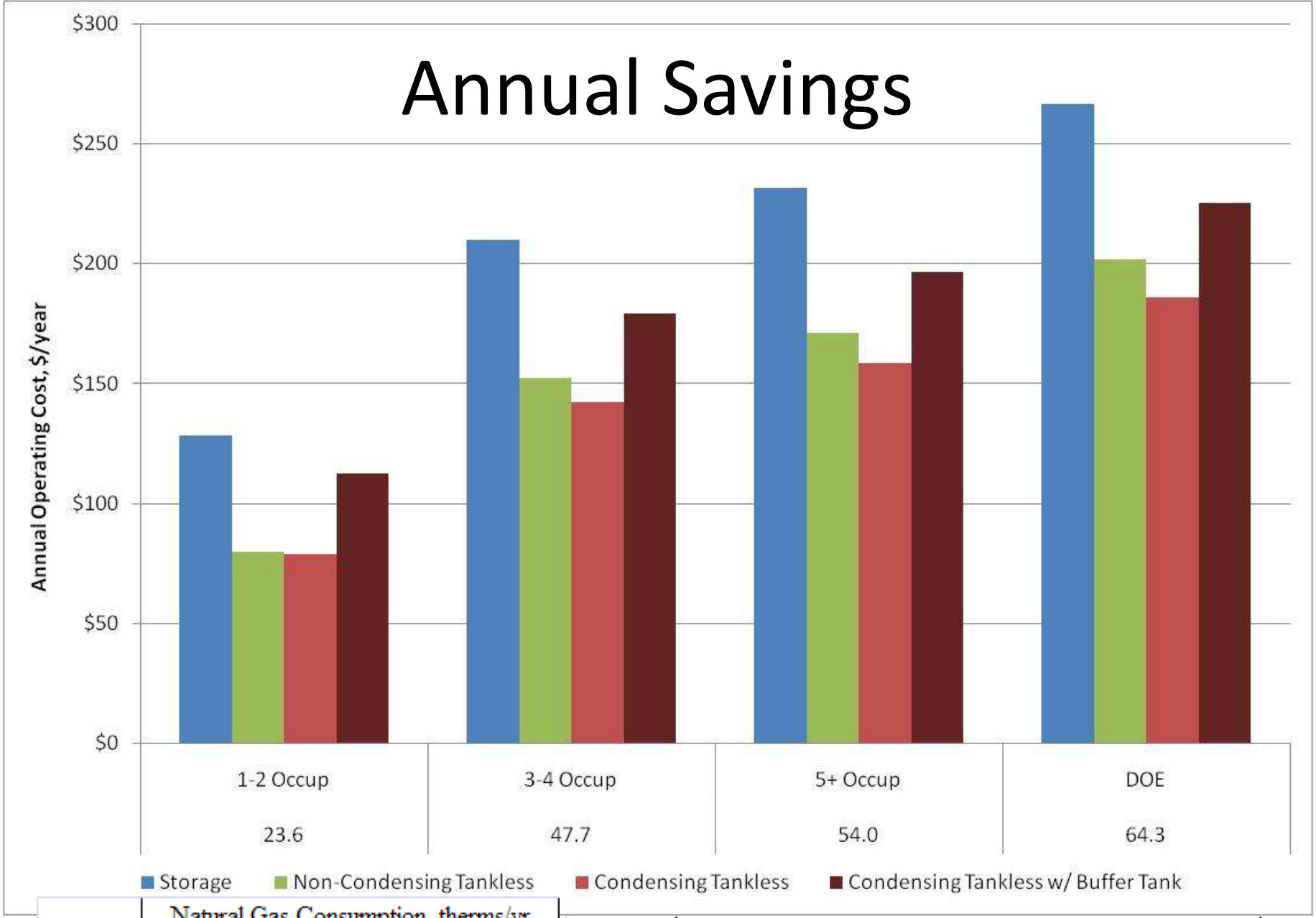
Rated vs Measured Daily Efficiencies



	$\frac{EF - Measured\ Eff}{EF}$	
	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

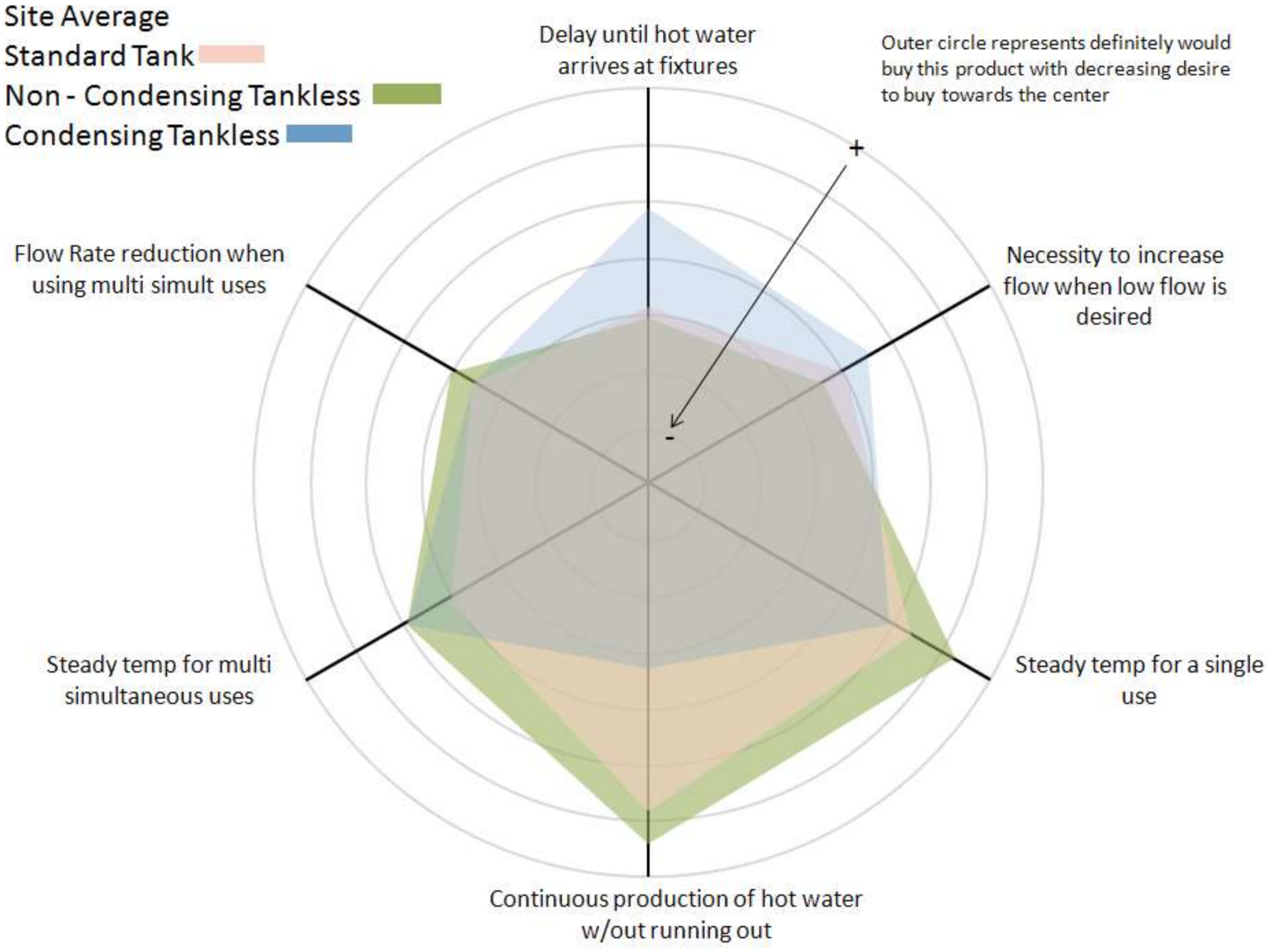
	Savings over StWH, $/yr (%)			
	1-2 ppl	3-4 ppl	5+ ppl	EF
NTWH	$48 (38%)	$58 (28%)	$61 (26%)	$65(24%)
CTWH	$49 (38%)	$68 (32%)	$73 (31%)	$80 (30%)
CTWH1	$16 (12%)	$31 (15%)	$35 (15%)	$41 (15%)

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



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.