3C: Gas Heat Pump Water Heating in Commercial Laundries

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Commercial Laundry Overview

- **Commercial Laundries, or "On Premise Laundries" Use A Lot of Hot Water & Energy**
- **Hotels, Prisons, Universities, Nursing Homes, Hospitals and "Industrial"**
- **140-170^{o}F Temperature**

Commercial Laundry Overview

- **Washer-Extractor**
  - **~3-4 gallons per lbm**
  - **35 – 800 lbm models**
- **Tunnel Washers**
  - **~2 gallons per lbm**
- **Set of Queen-Size Sheets**
  - **~3 lbs**

Commercial Laundry Overview

- **Gas Boilers at 78-92% Efficiency**
- **Very large, consistent, year-round hot water demands**

Excellent Opportunity for Gas Absorption Heat Pumps to Reduce Energy Use

Gas-Fired Absorption Heat Pump

From Ambient Air

0.5

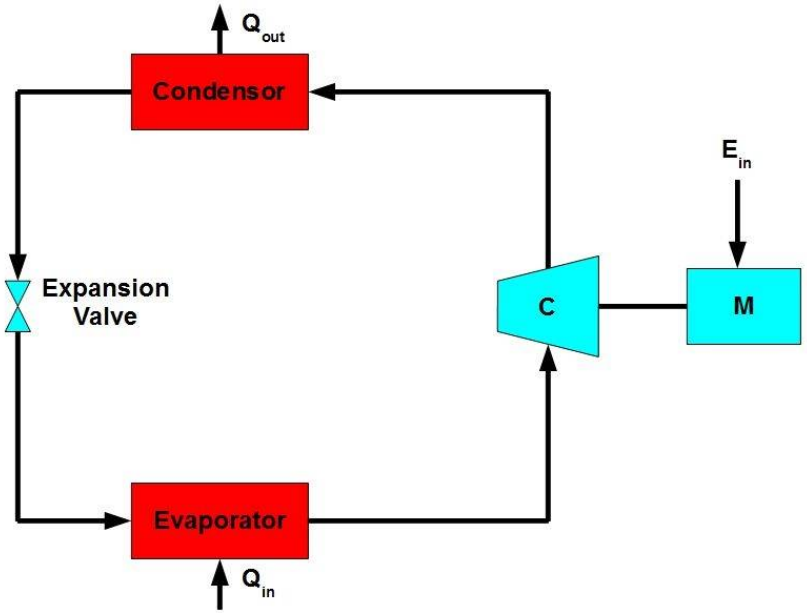
1.0

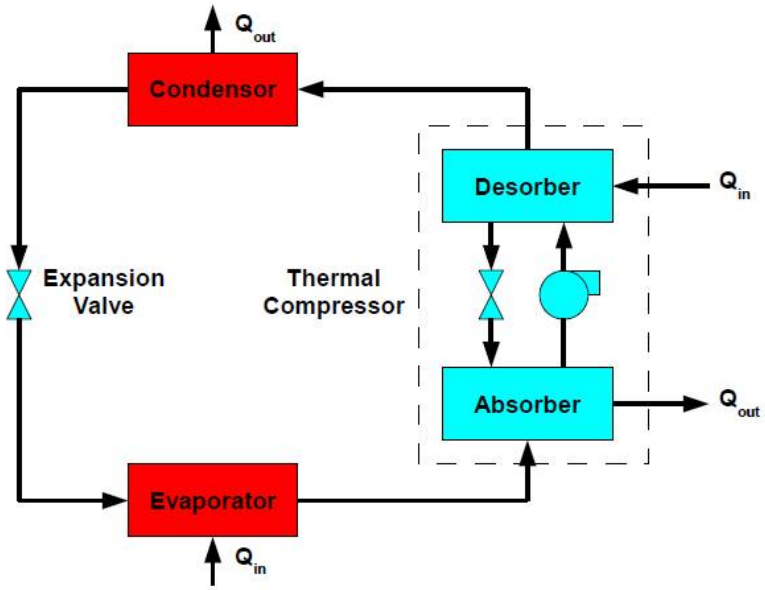
Fuel Source **

1.5

***** Natural Gas, Propane, Fuel Oil, BioDiesel, Renewable Gas, etc.***

How Does It Work?





$COP_h = Qcond/E_{in} = 3.0\text{-}4.0$

Qheat = ~1.1 x Qcooling

$COP_h = (Qcond + Qabs)/Q_{in} = 1.4\text{-}2.0$

Qheat = (Qcond + Qabs) ~ 2.5 times Qevap

Capacity & COP Remain High at Low Ambient Temperatures

SMTI Gas Absorption Heat Pumps

COP_{HHV} = 1.45 at 47/120°F

- Gas-Fired, Air to Water Heat Pump
- Condensing
- 4:1 Modulation

- 10,000 to 140,000 Bth Heating Output Models
- 20° F Hydronic Differential

- Outdoor Installation (no venting)
- SCAQMD NOx Compliant
- GWP = 0

Patents Pending

Family of GAHP Models

10 kBth **20 kBth** **80 kBth** **140 kBth**

Anything In-Between

gti

UTD Utilization Technology Development

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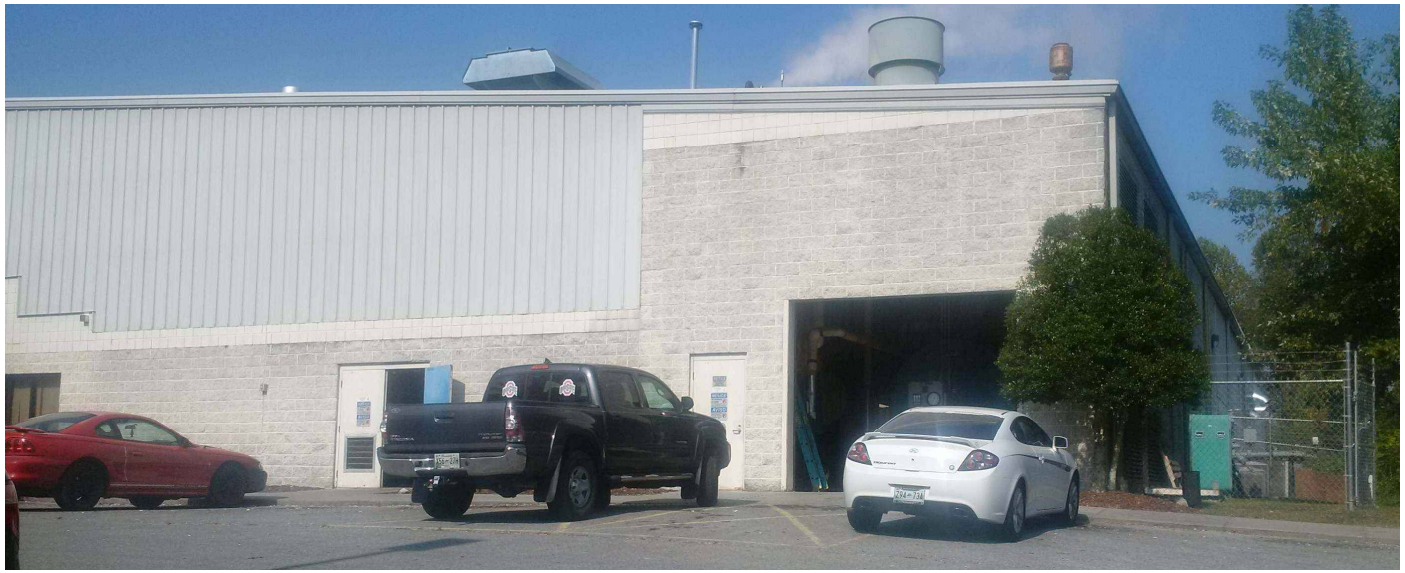
Commercial Laundry Field Test

Commercial Laundry Facility

- Laundry facility owns and washes linens (sheets, robes, etc.) for surrounding health care facilities
- Operating 2 shifts, 6 days per week
- Total facility uses roughly 50-60K gallons of hot water daily
- System targeted for GAHP field install estimated to use 10K-20K gallons of hot water daily



Current Boiler Based Water Heating System

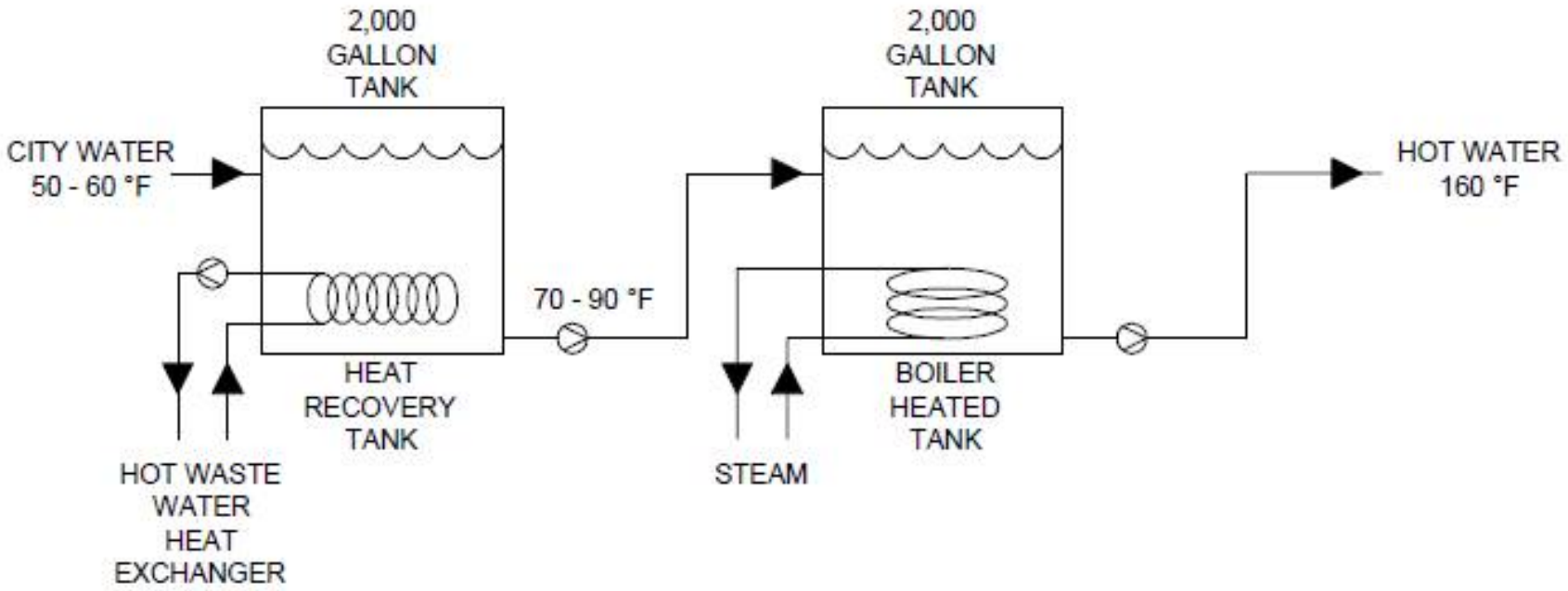
Nominal 80% Natural gas fired boiler 20+ Years Old

Steam Heated Tank

Heat Recovery Tank

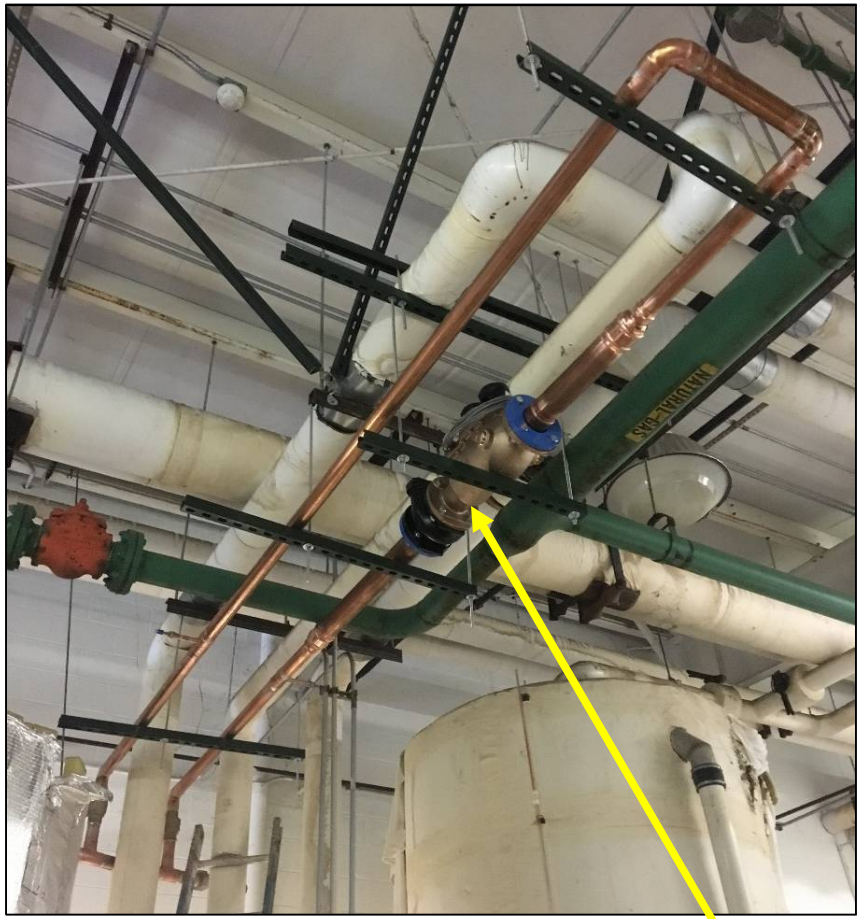
Kewanee: 21 million bth input (19,536 lb/hr)

Current Boiler Based Water Heating System



Baseline Monitoring of Hot Water Usage

- Bypass loop installed between two storage tanks
- Flow meter installed in loop



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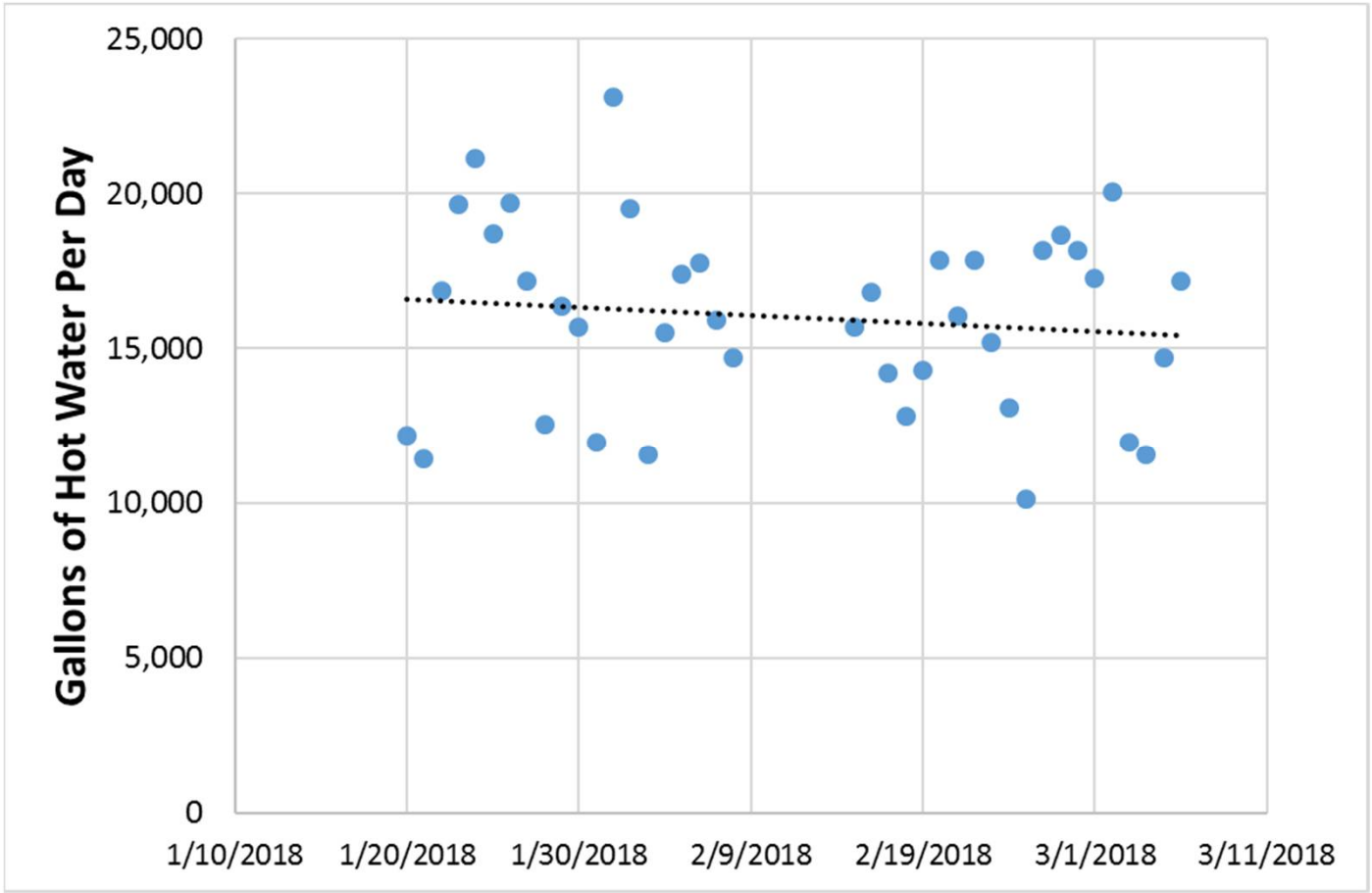
Baseline Monitoring of Hot Water Usage



~50 draws per 8 hrs | ~ 70 gpm (~160 gal/draw)

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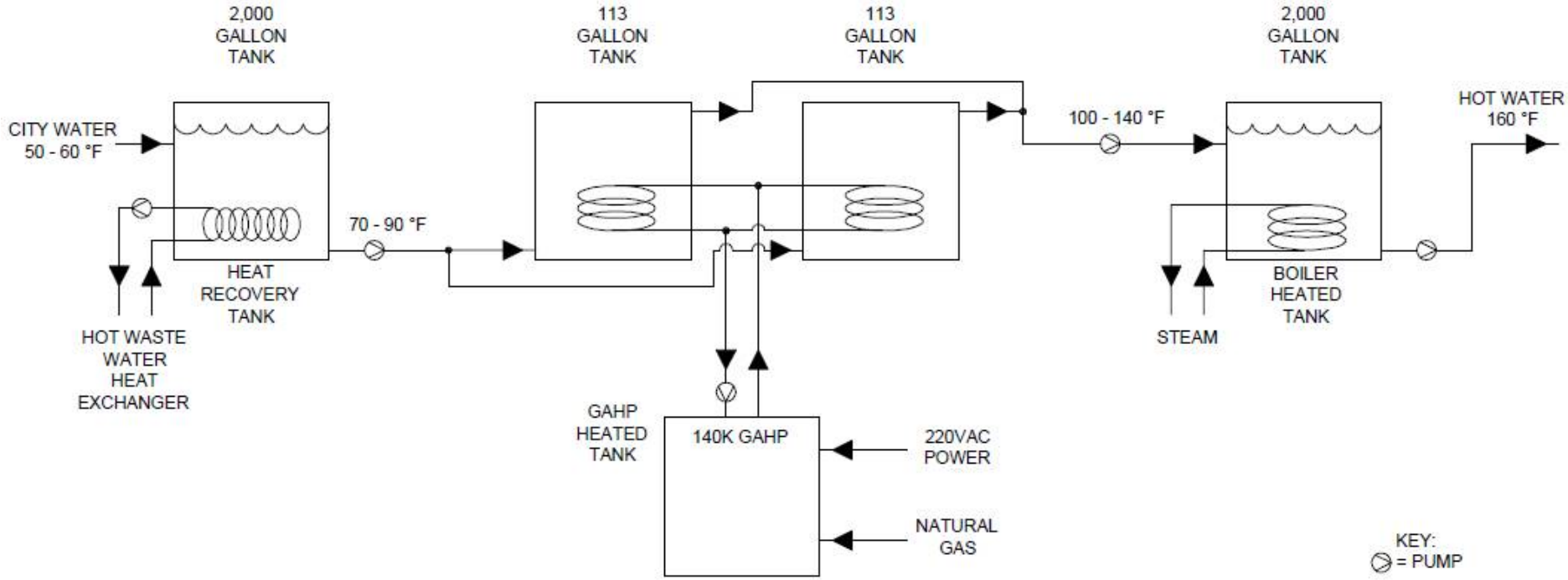
Baseline Monitoring of Hot Water Usage

- Hot Water Outlet: 153 – 167^{o} F
- Cold Water Inlet: 53 – 55^{o} F

- ~ 140 therms hot water/day
- ~ 180 therms gas/day
- ~ $160/day
- ~ $50,000/year

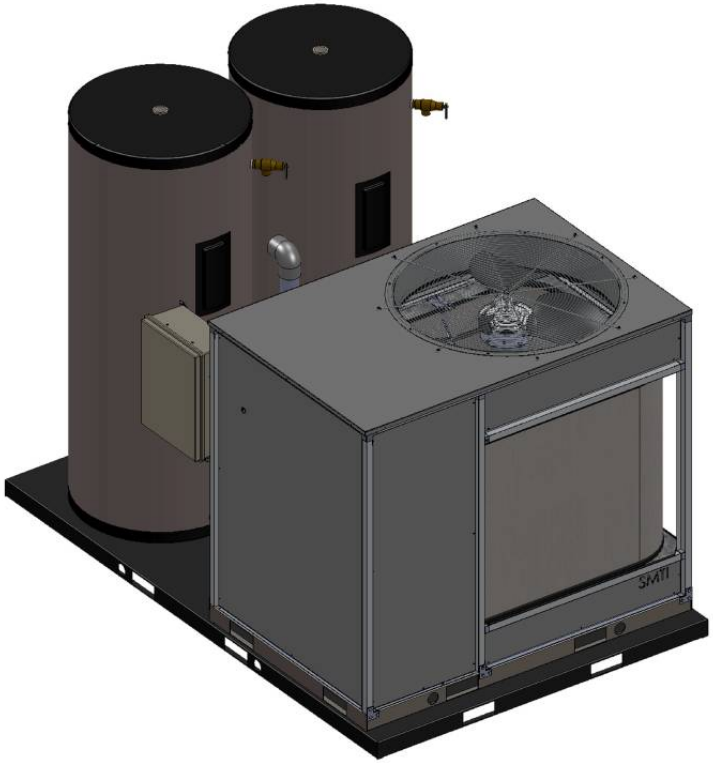
Field Installed GAHP System

- GAHP will preheat water before flow to steam heated tank
- GAHP should provide almost continuous baseload water heating

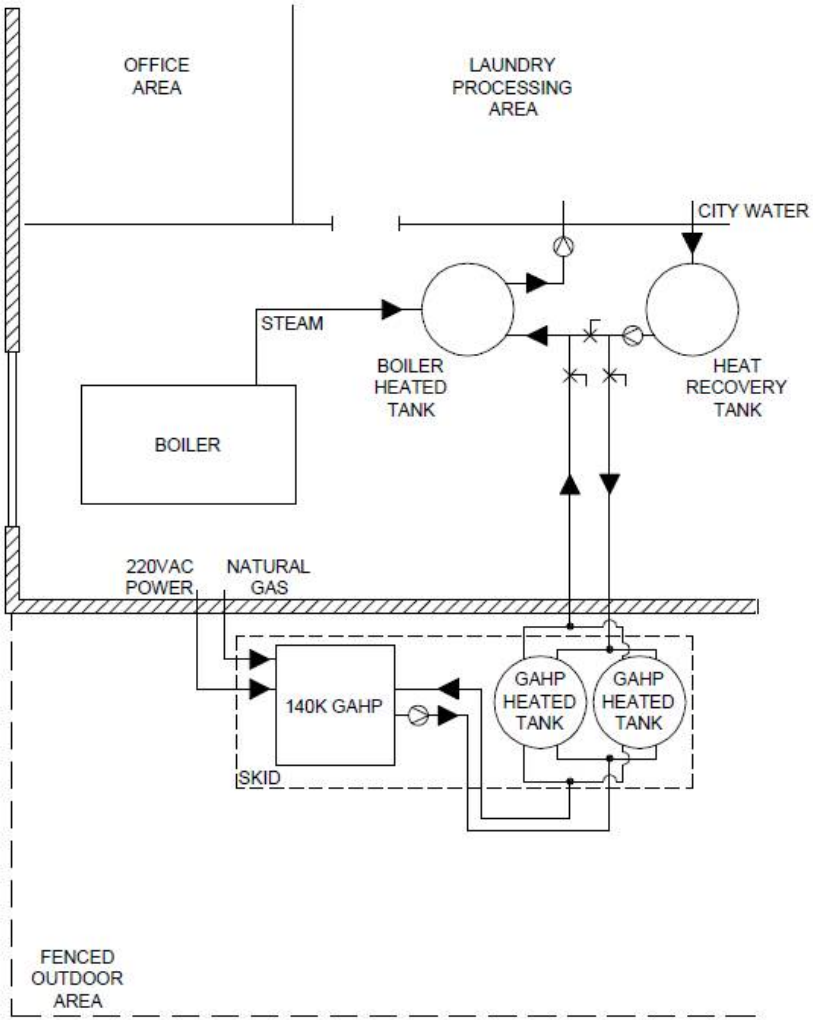


Field Installed GAHP

GAHP skid to be installed in late March 2018

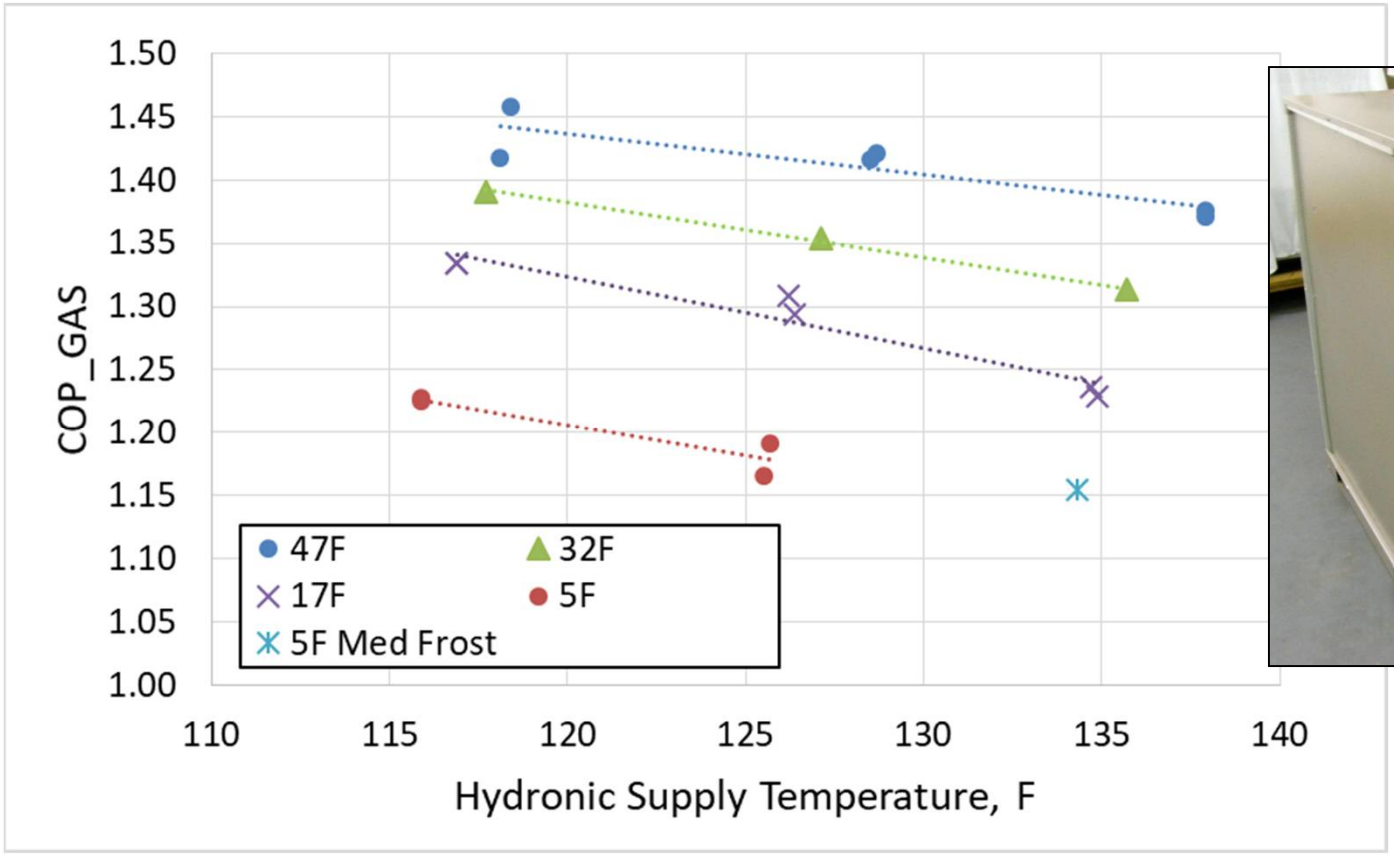


Lochinvar SET 119 Indirect Tanks



140 kBtu/hr GAHP “Beta 2”

- **Beta 2 is highest performing 140K prototype to date**
- **COP of 1.44 at 47/100°F design**



Estimated Energy and Cost Savings

For Single 140 kbth GAHP prototype installed at field test site

Assumptions:

- GAHP COP of 1.4
- Boiler COP of 0.8
- Natural Gas: $0.904 per therm
- Electric cost: $0.10 per kWhr

Anticipated Economics:

Gas Therms Saved/Year:	3744
Gas Savings/Year:	$3,385
kWhr Used/Year:	2000
kWhr Cost/Year:	$200
Net Savings/Year:	$3,185
Simple Payback:	~3.5 years (one 140 kBth GAHP)
	~2.8 years (two 140 kBth GAHPs)

Summary

- Commercial laundry facilities are significant consumers of hot water
- Baseline monitoring of field test with GAHP providing baseline heating underway
- Commercial GAHP water heaters have the potential to significantly reduce energy use and operating cost
- Reasonable paybacks expected based on yearly savings

Other GAHP Projects in 2018

- 3 residential combi field tests in cold climate regions
- 2 full-service restaurant water heating/space cooling field tests in Los Angeles
- Six residential water heater field tests in Los Angeles
- Multi-family combi field test in Chicago
- 20 kbtu/hr residential combi prototype (net zero energy)
- Fuel-oil / Bio-diesel residential combi prototype

Acknowledgments

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Thank You!

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