



Hot Water

**The
Efficiency
Challenge!**

...and all restaurants
use hot water!



...but how much hot water?

How much hot water do you use?

Without this...



...you don't
know!

What we see in the field...







































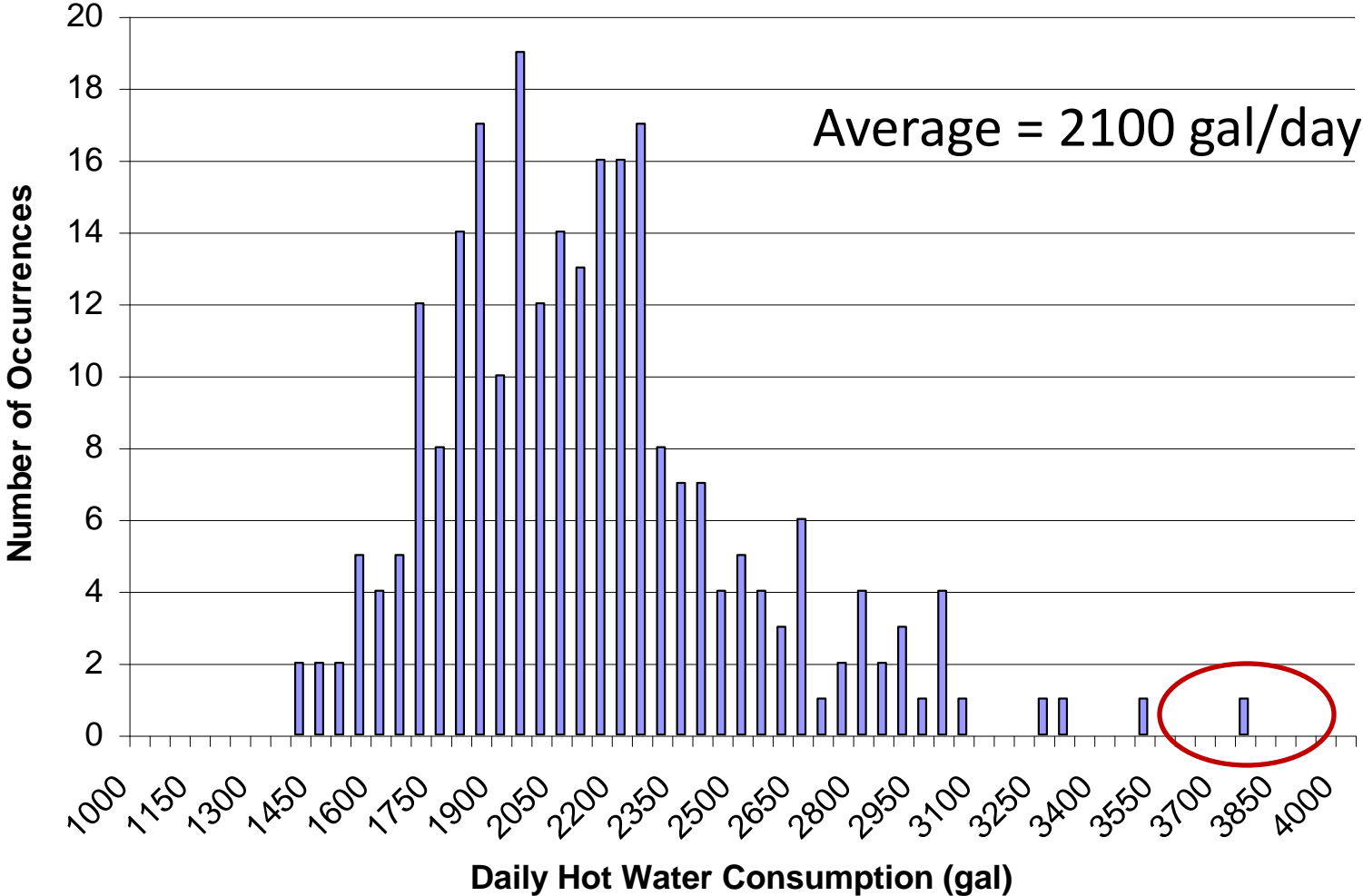


U.S. to Canadian Translation:

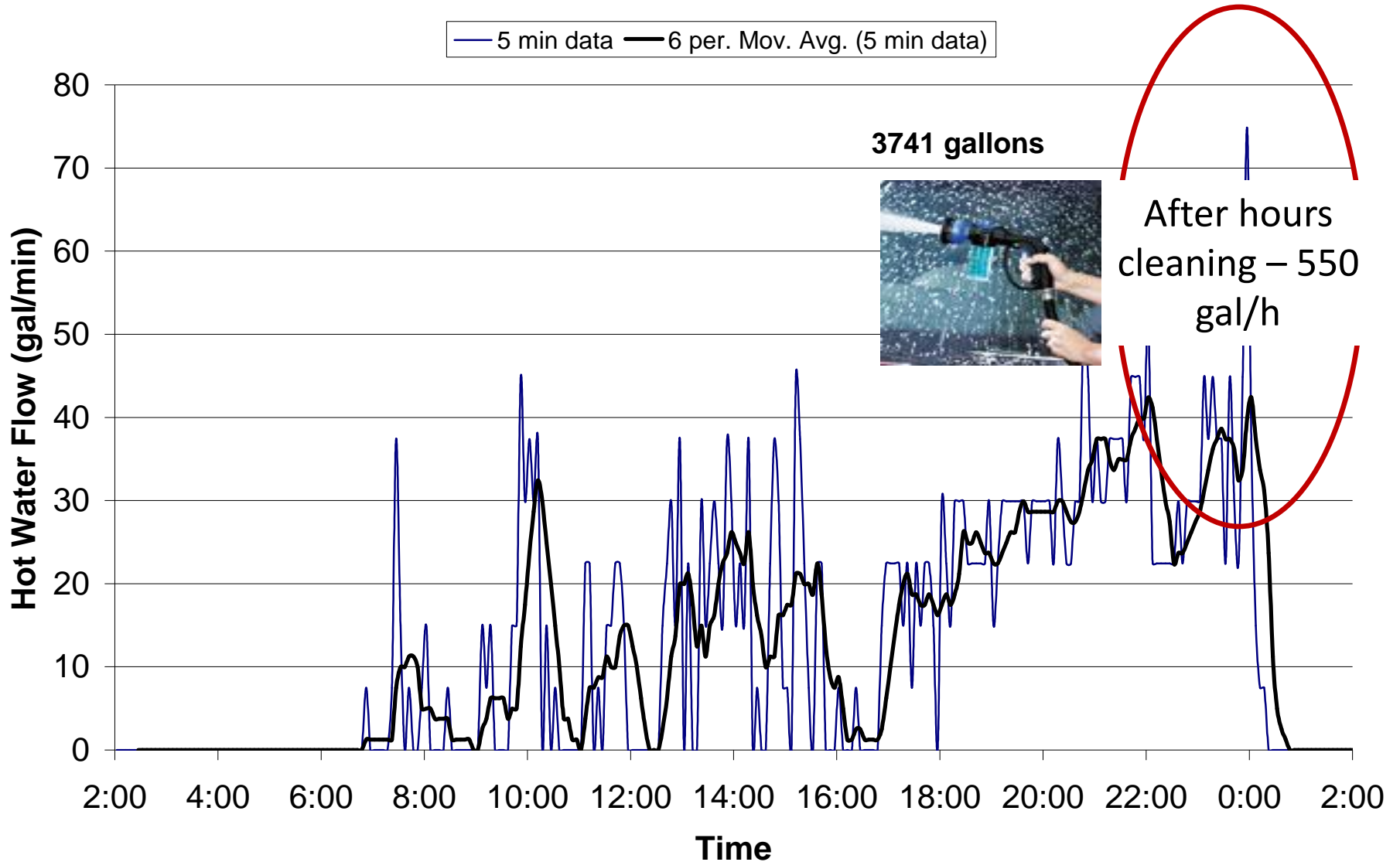
1 U.S. gal (shown in subsequent graphs)
is equal to approximately 4 litres

Multiply gal x 4 to get Litres

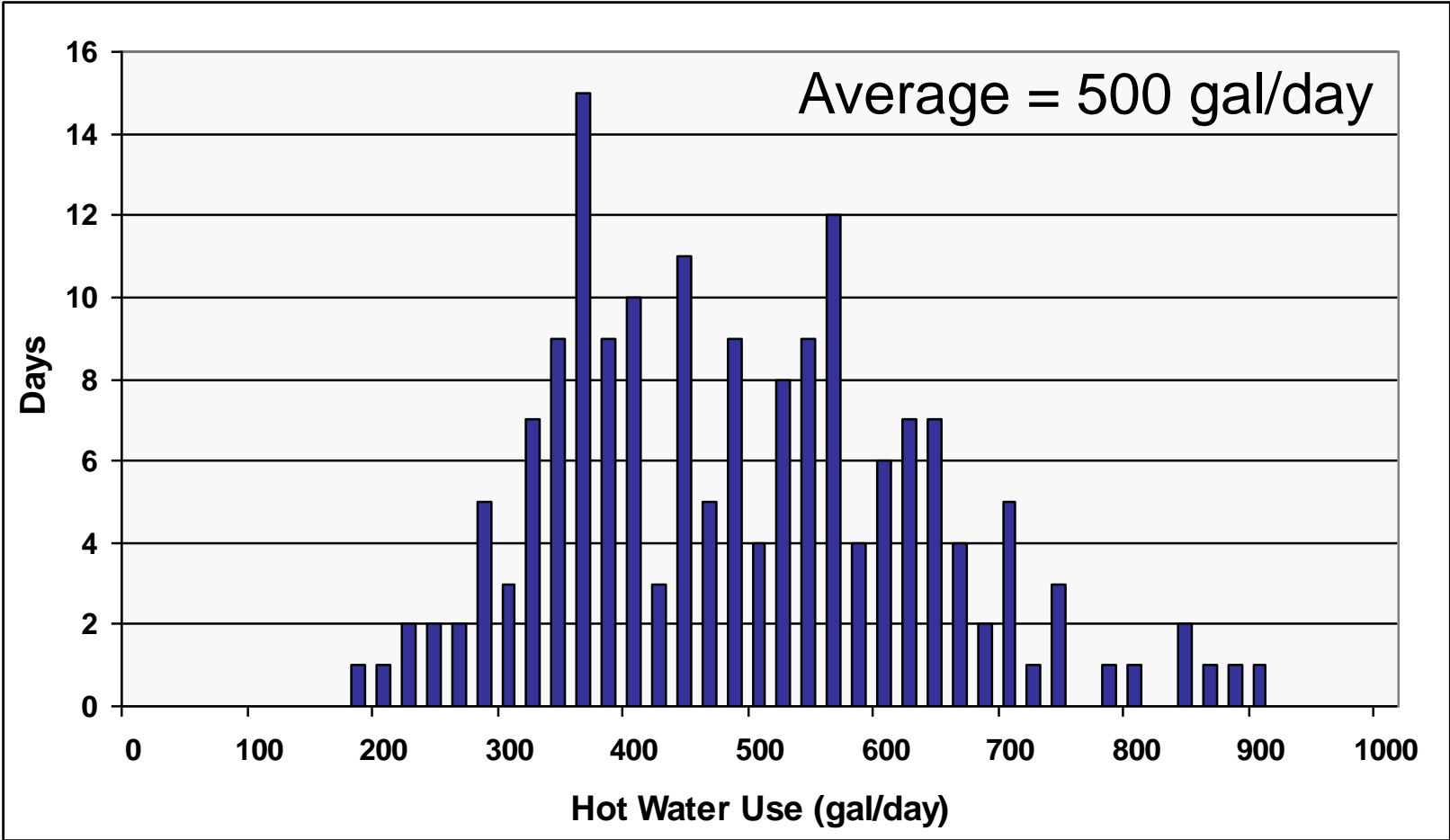
Actual Daily Hot Water Consumption for a Full-Service Restaurant (FSR)



24 hour Hot Water Flow Rate Profile



Actual Daily Hot Water Consumption for a Quick-Service Restaurant (QSR)



Restaurant Hot Water Use*

	Steakhouse	Quick Service
water heating load [gal/d]	3500	240

Full-Service \neq Quick Service

&

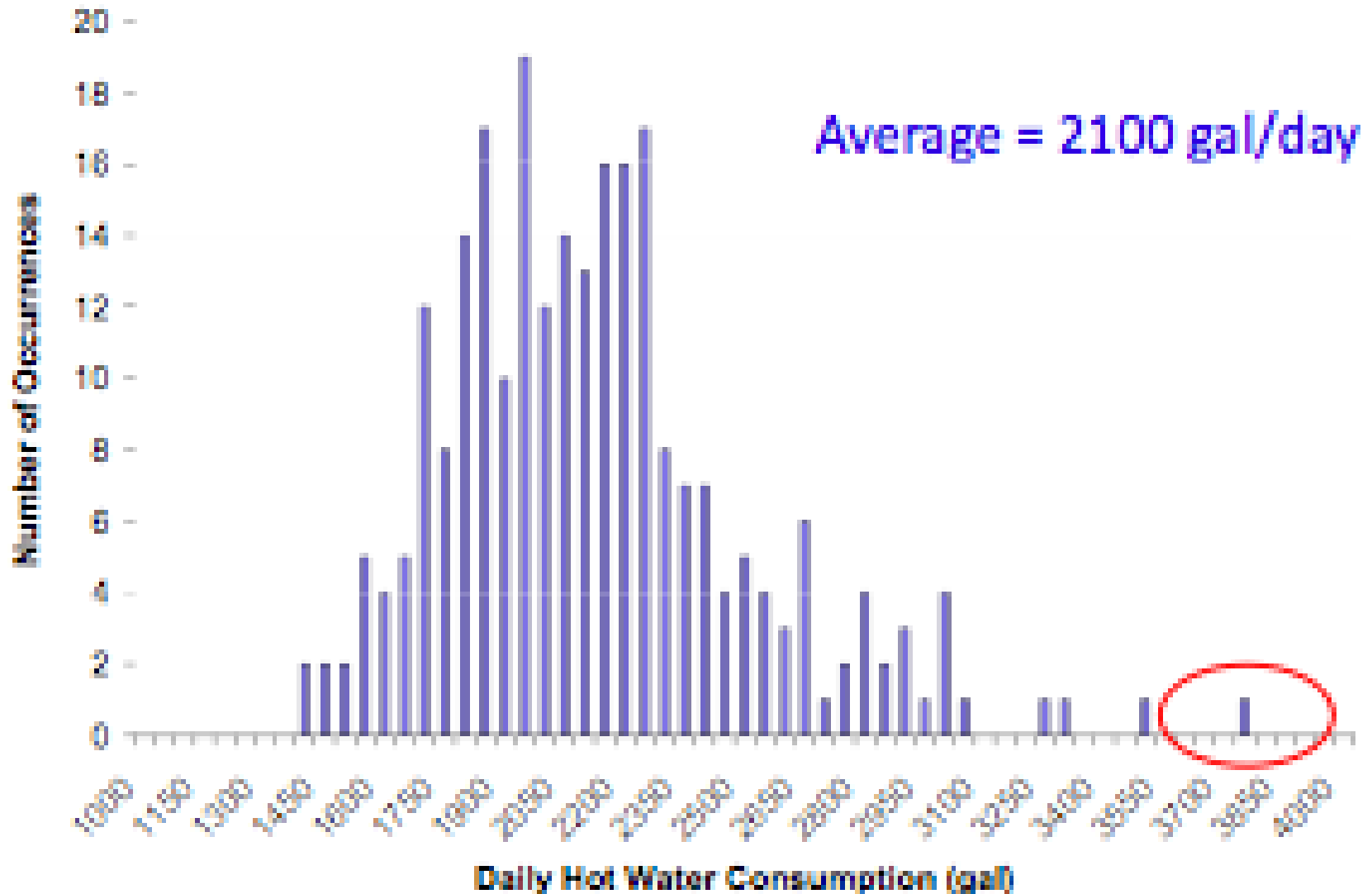
Restaurant \neq Residential

* EPRI Commercial Water Heating Applications Handbook, 1992

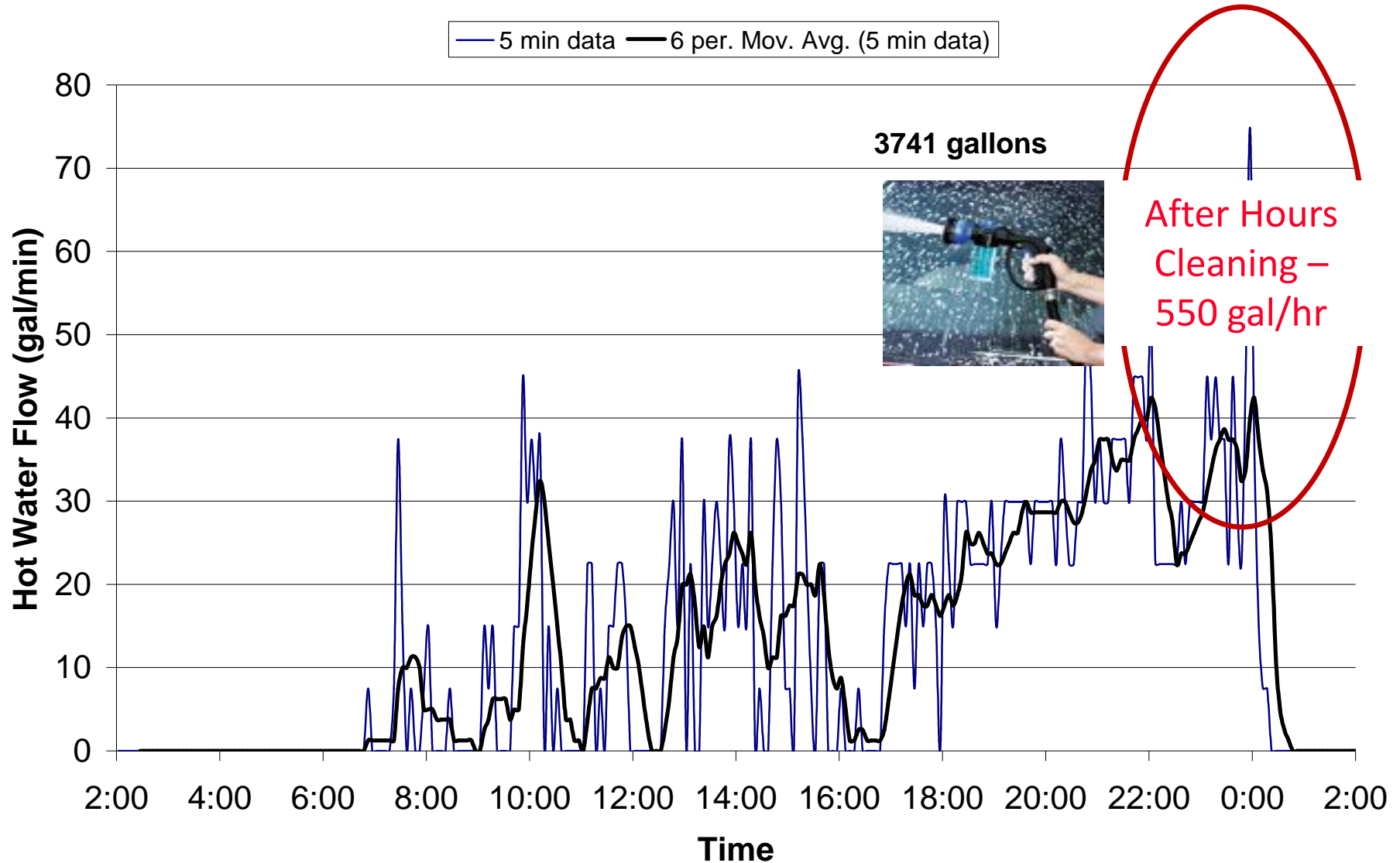
FSTC monitored facilities to date...

Facility	Hot Water Use (avg. gal/day)	Efficiency (%)	Notes
Corp. Cafeteria	1800	48	Large Recirculation Lg. Recirc + Eff. Heater
Supermarket	1100	45	
Full Service 1	3700	65	Recirculation
Full Service 2	2500	71	Recirculation
Full Service 3	2300	73	Recirculation
Full Service 4	2100	68	Recirculation
Quick Service 1	1200	69	Small Recirculation
Quick Service 2	700	NA	Recirculation
Quick Service 3	500	90	High-Eff. Heater
Quick Service 4	550	71	Simple Distribution
Coffee Shop	150	62	Simple Distribution

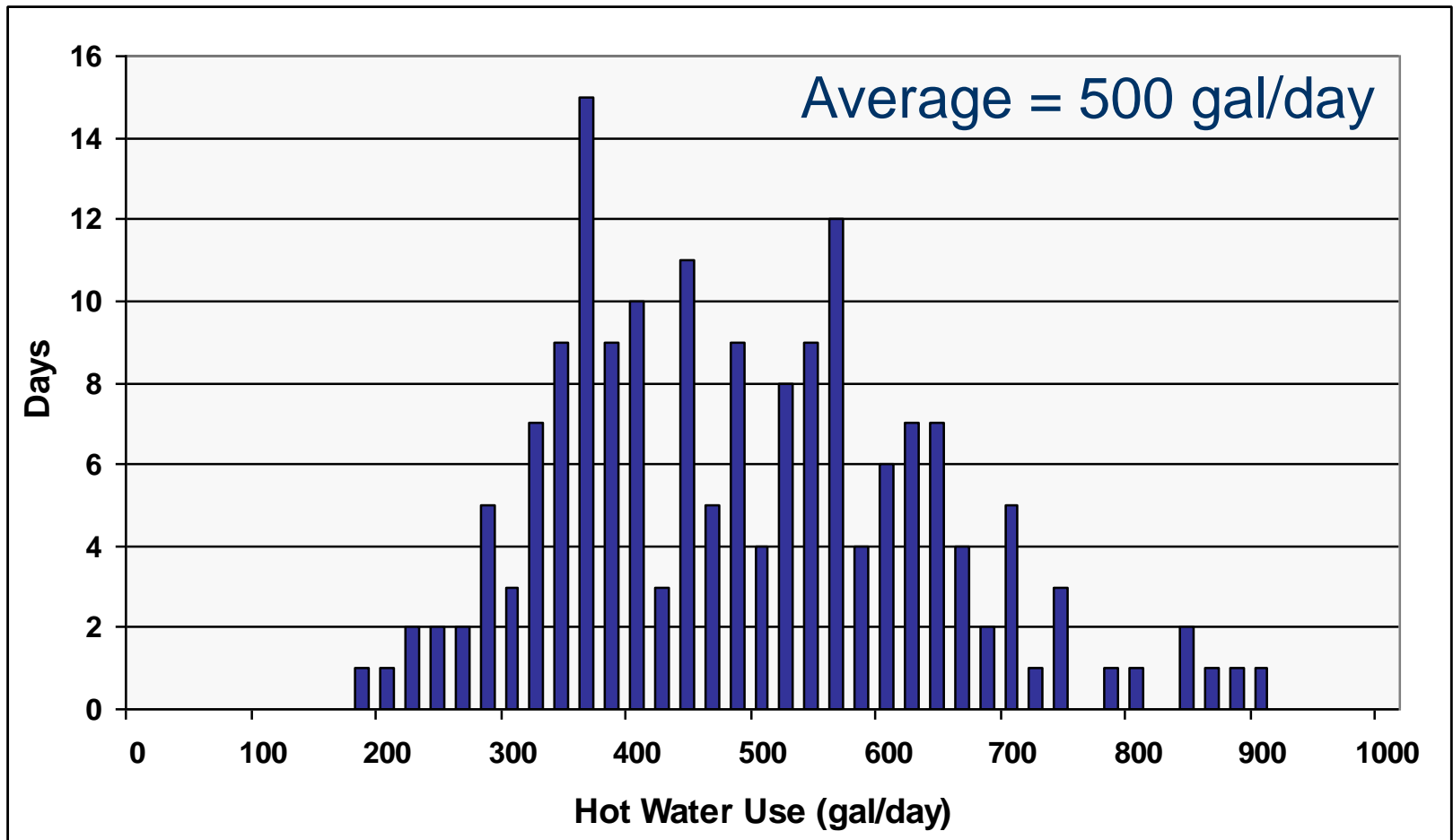
Actual Daily Hot Water Consumption for a Full-Service Restaurant



24 hour Hot Water Flow Profile



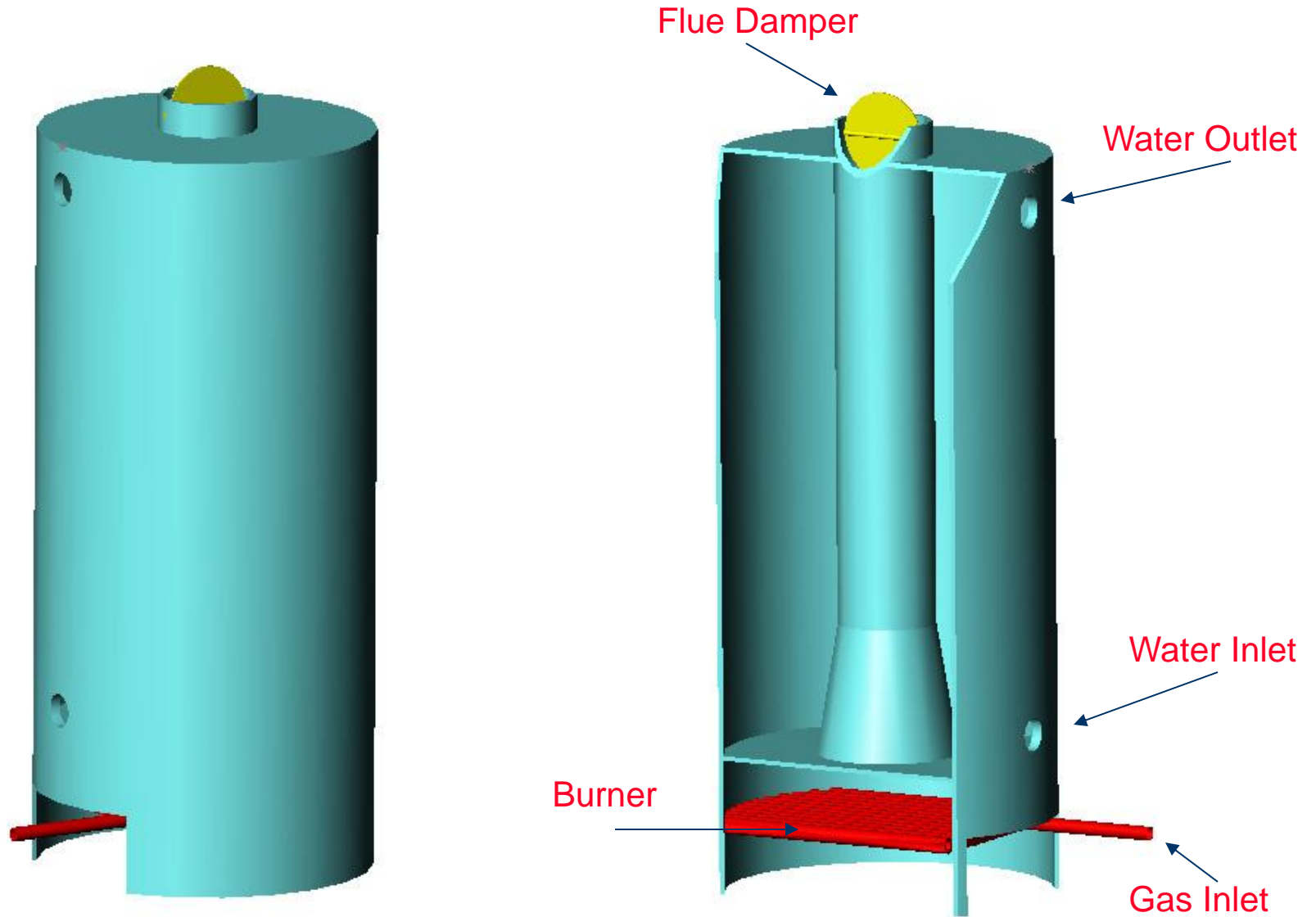
Actual Daily Hot Water Consumption for a Quick-Service Restaurant



Let's start at the beginning...

Types of Hot Water Heaters

Standard Efficiency Water Heater



Standard Efficiency

Pros

- simple
- robust
- low cost
- industry standard
- easy to spec
- easy to fix
- easy to replace

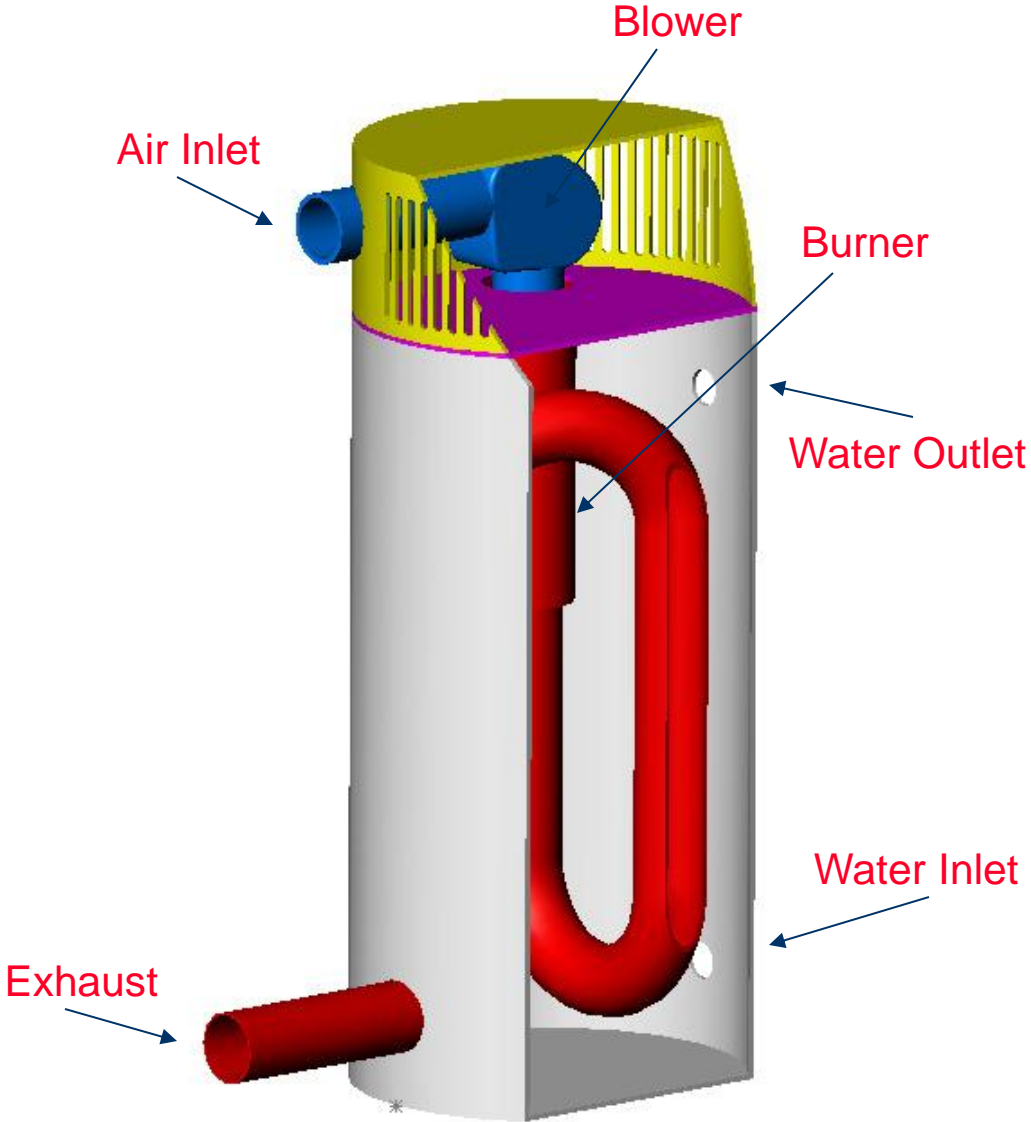
Cons

- 80% thermal efficiency
- stand by loss (100 gal): 1000 – 1300 Btu/h



<http://www.gamanet.org>

High Efficiency (Condensing) Water Heater



High Efficiency

Pros

- condensing
- 95%+ efficiency
- Standby loss: 600 – 1000 Btu/h
- potential lower cost installation

Cons

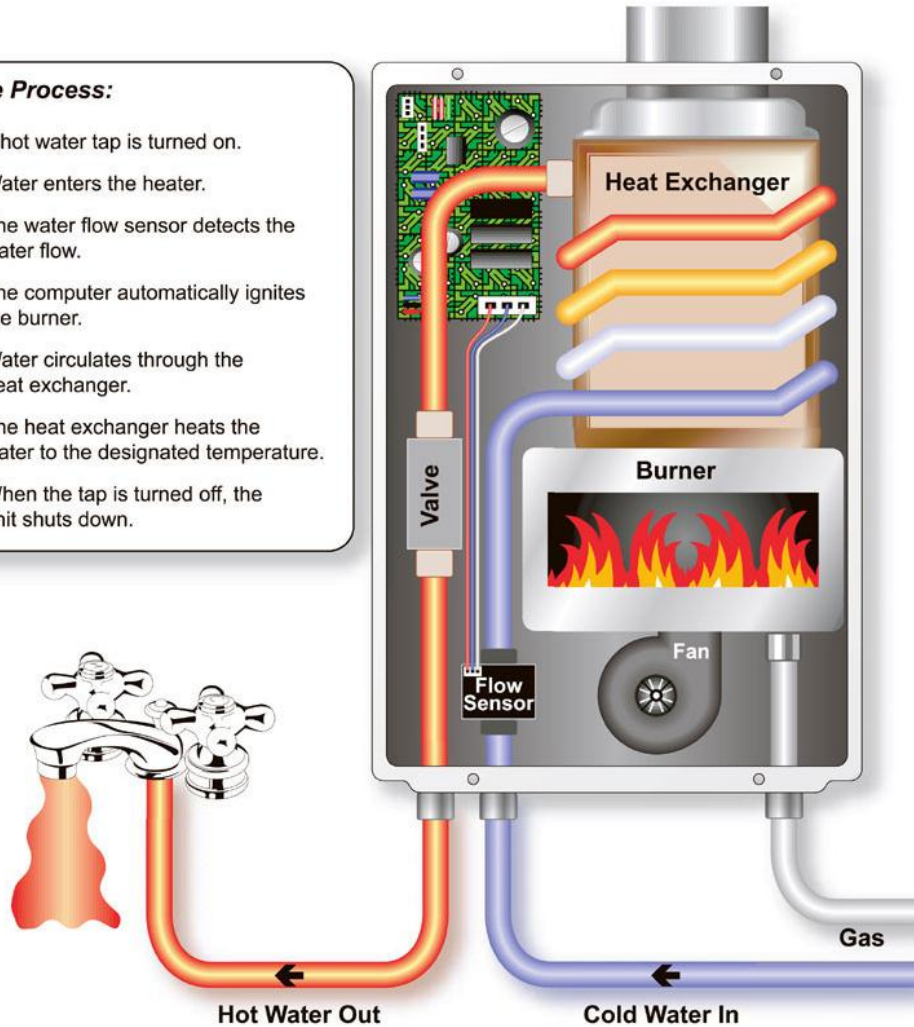
- condensing
- more complex
- not the standard
- potential for repair delay
- higher first cost



Tankless (Instantaneous)

The Process:

1. A hot water tap is turned on.
2. Water enters the heater.
3. The water flow sensor detects the water flow.
4. The computer automatically ignites the burner.
5. Water circulates through the heat exchanger.
6. The heat exchanger heats the water to the designated temperature.
7. When the tap is turned off, the unit shuts down.



Tankless

Pros

- smaller footprint
- outside installation possible (some climates)
- no standby loss

Cons

- 80 - 84% thermal efficiency
- low-flow limits
- may need multiple units
- special installation required (stainless venting)
- maintenance may be higher

High efficiency condensing models (>94%) are now available in Canada!

Quick Service Restaurant Case Study

Avg. Hot Water Use = 550 gal/day

Water Heater Configuration	Set. Pt. (°F)	Efficiency (%)	Inlet Temp (deg. F)	Outlet Temp (°F)	Gas Use* (therm/yr)	Gas Cost* (\$/yr)
Std. Eff. Tank	140	70.3	69.3	143.2	1977	\$2,372

*Annual consumption/cost projection normalized for 550 gal/day, inlet temperature of 60°F and \$1.20/therm

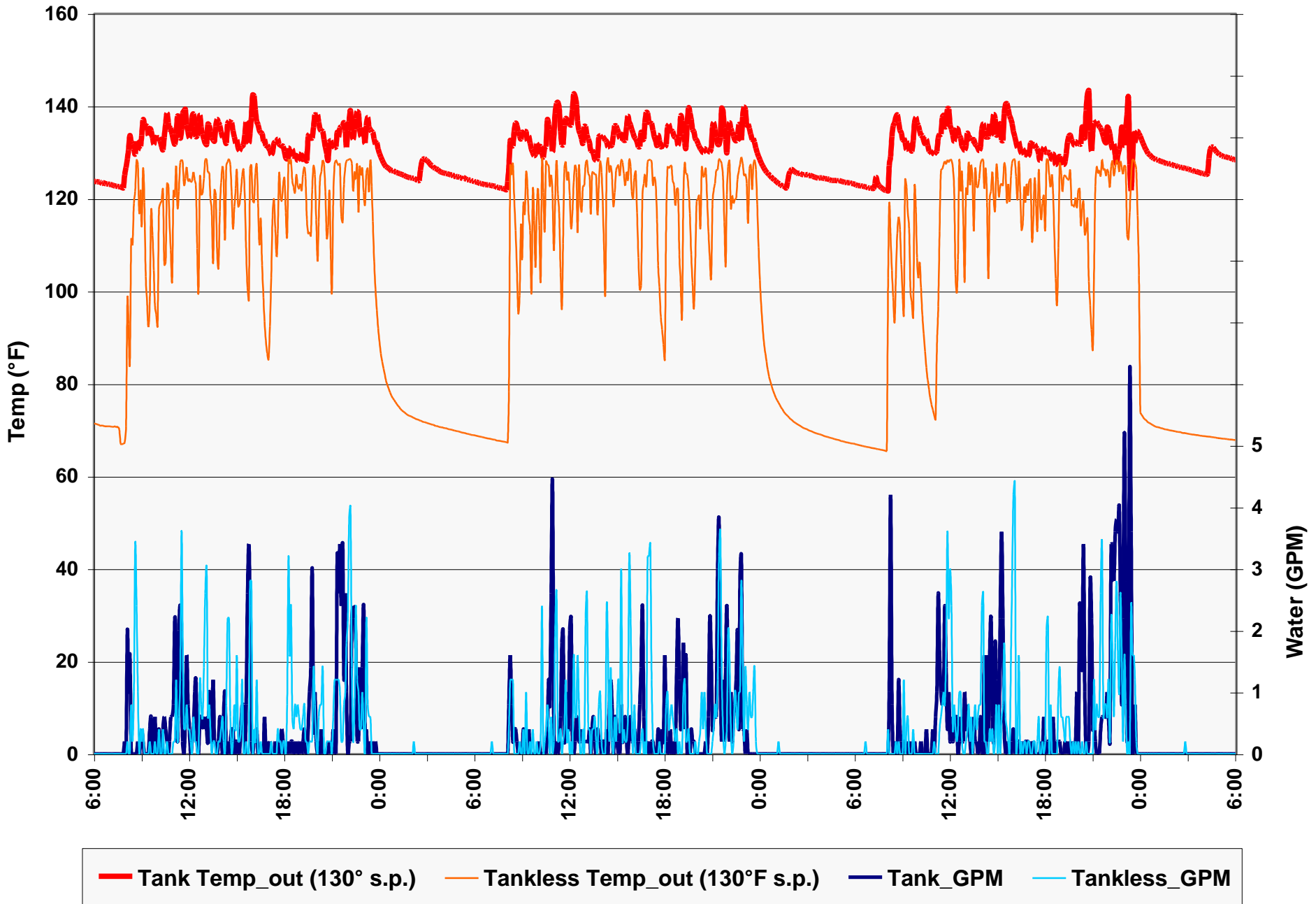
Water Heater Configuration	Set. Pt. (°F)	Efficiency (%)	Inlet Temp (deg. F)	Outlet Temp (°F)	Gas Use* (therm/yr)	Gas Cost* (\$/yr)
Std. Eff. Tank	140	70.3	69.3	143.2	1977	\$2,372
Std. Eff. Tank	130	71.4	65.2	135.5	1704	\$2,045

*Annual consumption/cost projection normalized for 550 gal/day, inlet temperature of 60°F and \$1.20/therm

Water Heater Configuration	Set. Pt. (°F)	Efficiency (%)	Inlet Temp (deg. F)	Outlet Temp (°F)	Gas Use* (therm/yr)	Gas Cost* (\$/yr)
Std. Eff. Tank	140	70.3	69.3	143.2	1977	\$2,372
Std. Eff. Tank	130	71.4	65.2	135.5	1704	\$2,045
Tankless Heater	130	73.6	65.1	124.9	1465	\$1,758

*Annual consumption/cost projection normalized for 550 gal/day, inlet temperature of 60°F and \$1.20/therm

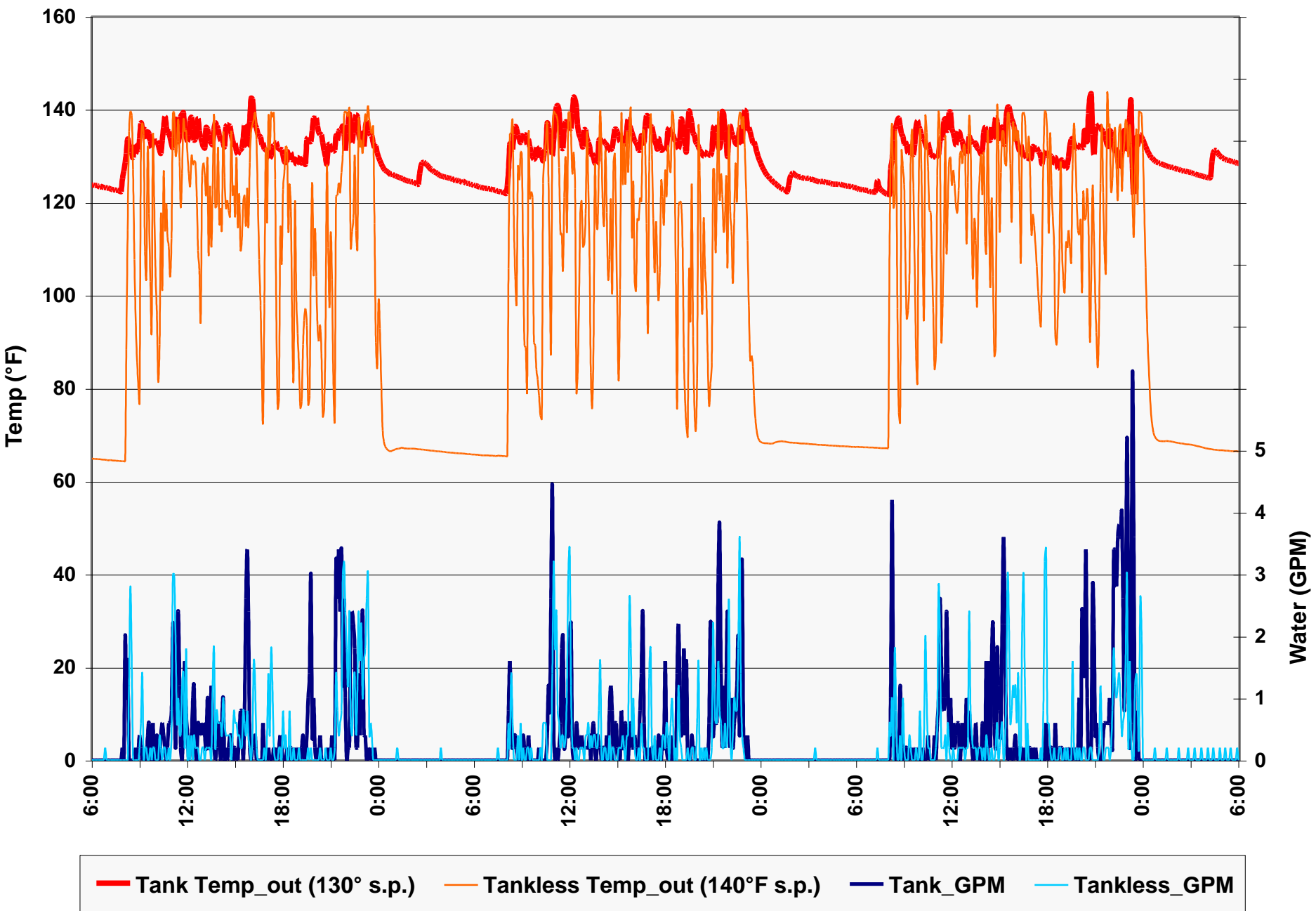
QSR 1: Tank vs. Tankless Water Heater Outlet Temperature



Water Heater Configuration	Set. Pt. (°F)	Efficiency (%)	Inlet Temp (deg. F)	Outlet Temp (°F)	Gas Use* (therm/yr)	Gas Cost* (\$/yr)
Std. Eff. Tank	140	70.3	69.3	143.2	1977	\$2,372
Std. Eff. Tank	130	71.4	65.2	135.5	1704	\$2,045
Tankless Heater	130	73.6	65.1	124.9	1465	\$1,758
Tankless Heater	140	75.6	62	132.8	1607	\$1,928

*Annual consumption/cost projection normalized for 550 gal/day, inlet temperature of 60°F and \$1.20/therm

QSR 1: Tank vs. Tankless Water Heater Outlet Temperature



Water Heater Configuration	Set. Pt. (°F)	Efficiency (%)	Inlet Temp (deg. F)	Outlet Temp (°F)	Gas Use* (therm/yr)	Gas Cost* (\$/yr)
Std. Eff. Tank	140	70.3	69.3	143.2	1977	\$2,372
Std. Eff. Tank	130	71.4	65.2	135.5	1704	\$2,045
Tankless Heater	130	73.6	65.1	124.9	1465	\$1,758
Tankless Heater	140	75.6	62	132.8	1607	\$1,928
High Eff. Tank	130	92.1	54.4	134.7	1354	\$1,625

*Annual consumption/cost projection normalized for 550 gal/day, inlet temperature of 60°F and \$1.20/therm

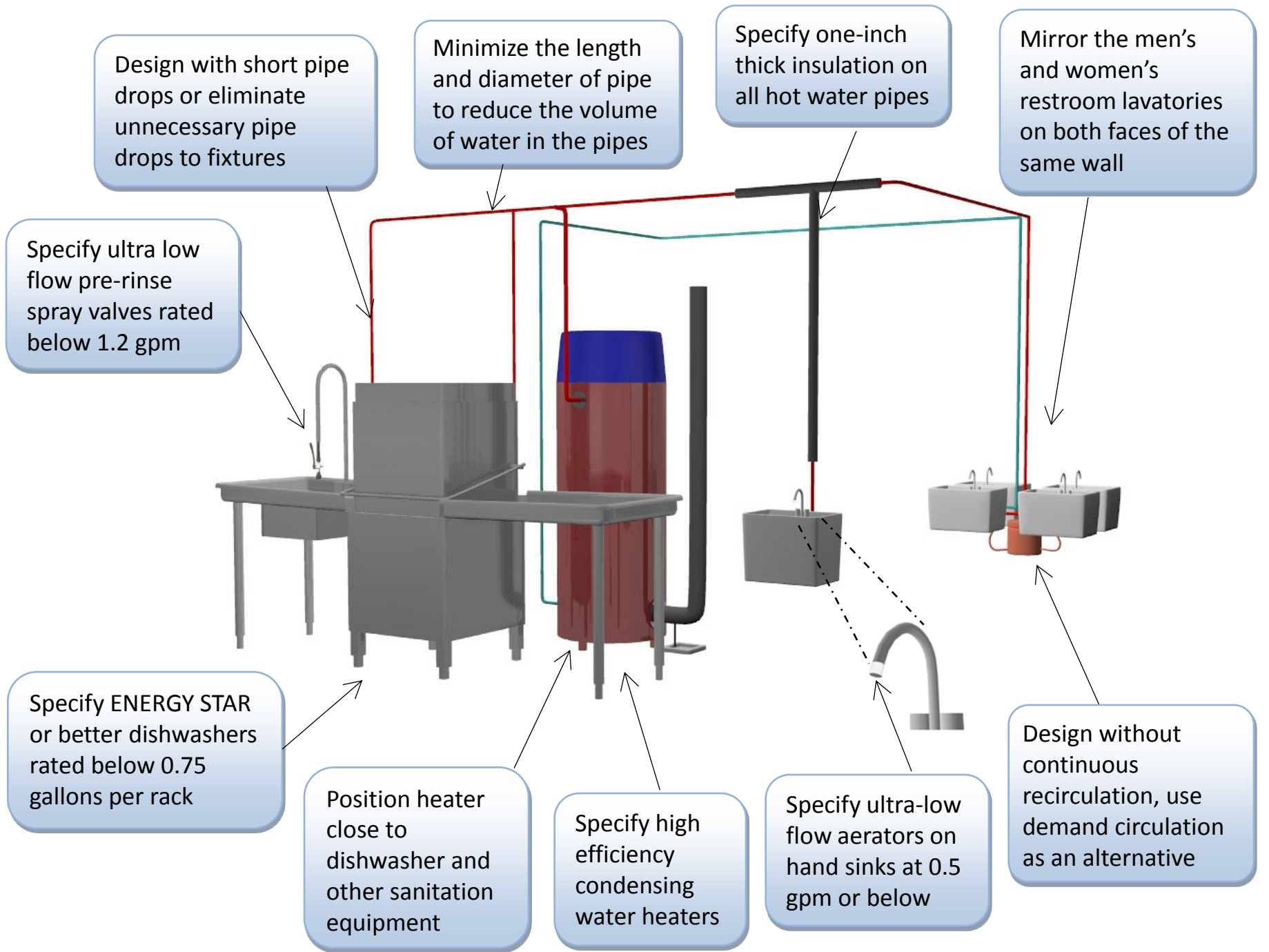
Store is saving \$750 with high-efficiency heater in operation over the as-installed standard efficiency tank heater.

Water Heater Configuration	Set. Pt. (°F)	Efficiency (%)	Inlet Temp (deg. F)	Outlet Temp (°F)	Gas Use* (therm/yr)	Gas Cost* (\$/yr)
Std. Eff. Tank	140	70.3	69.3	143.2	1977	\$2,372
Std. Eff. Tank	130	71.4	65.2	135.5	1704	\$2,045
Tankless Heater	130	73.6	65.1	124.9	1465	\$1,758
Tankless Heater	140	75.6	62	132.8	1607	\$1,928
High Eff. Tank	130	92.1	54.4	134.7	1354	\$1,625

*Annual consumption/cost projection normalized for 550 gal/day, inlet temperature of 60°F and \$1.20/therm

Store would have saved \$444 with the standard efficiency tankless heater over the as-installed standard efficiency tank heater.

Optimizing a hot water system



Design with short pipe drops or eliminate unnecessary pipe drops to fixtures

Minimize the length and diameter of pipe to reduce the volume of water in the pipes

Specify one-inch thick insulation on all hot water pipes

Mirror the men's and women's restroom lavatories on both faces of the same wall

Specify ultra low flow pre-rinse spray valves rated below 1.2 gpm

Specify ENERGY STAR or better dishwashers rated below 0.75 gallons per rack

Position heater close to dishwasher and other sanitation equipment

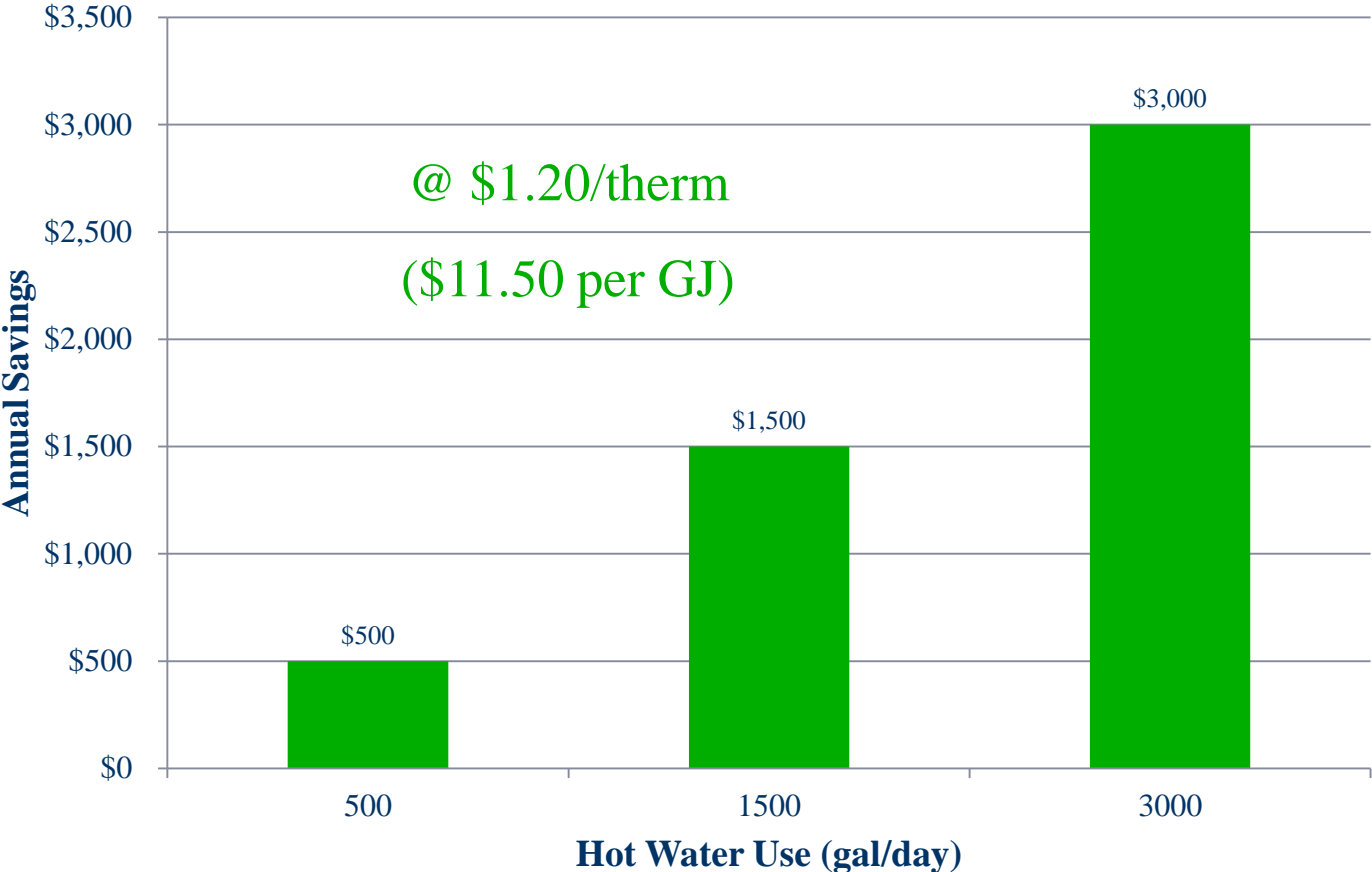
Specify high efficiency condensing water heaters

Specify ultra-low flow aerators on hand sinks at 0.5 gpm or below

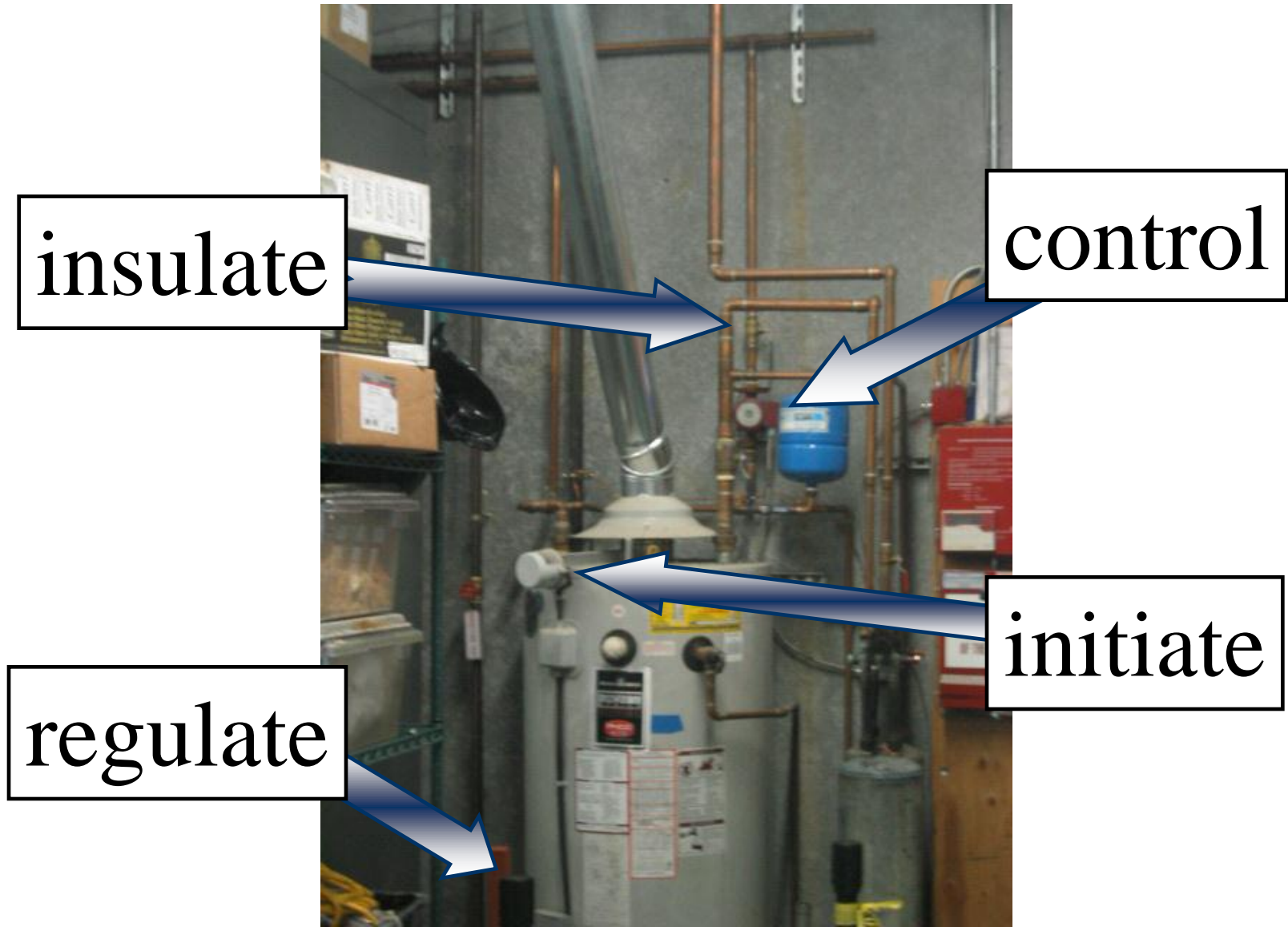
Design without continuous recirculation, use demand circulation as an alternative

Increasing Overall Water Heating
Efficiency From 60-80% Will Lead to...

Cost Savings Based on Efficiency Increase from 60-80%



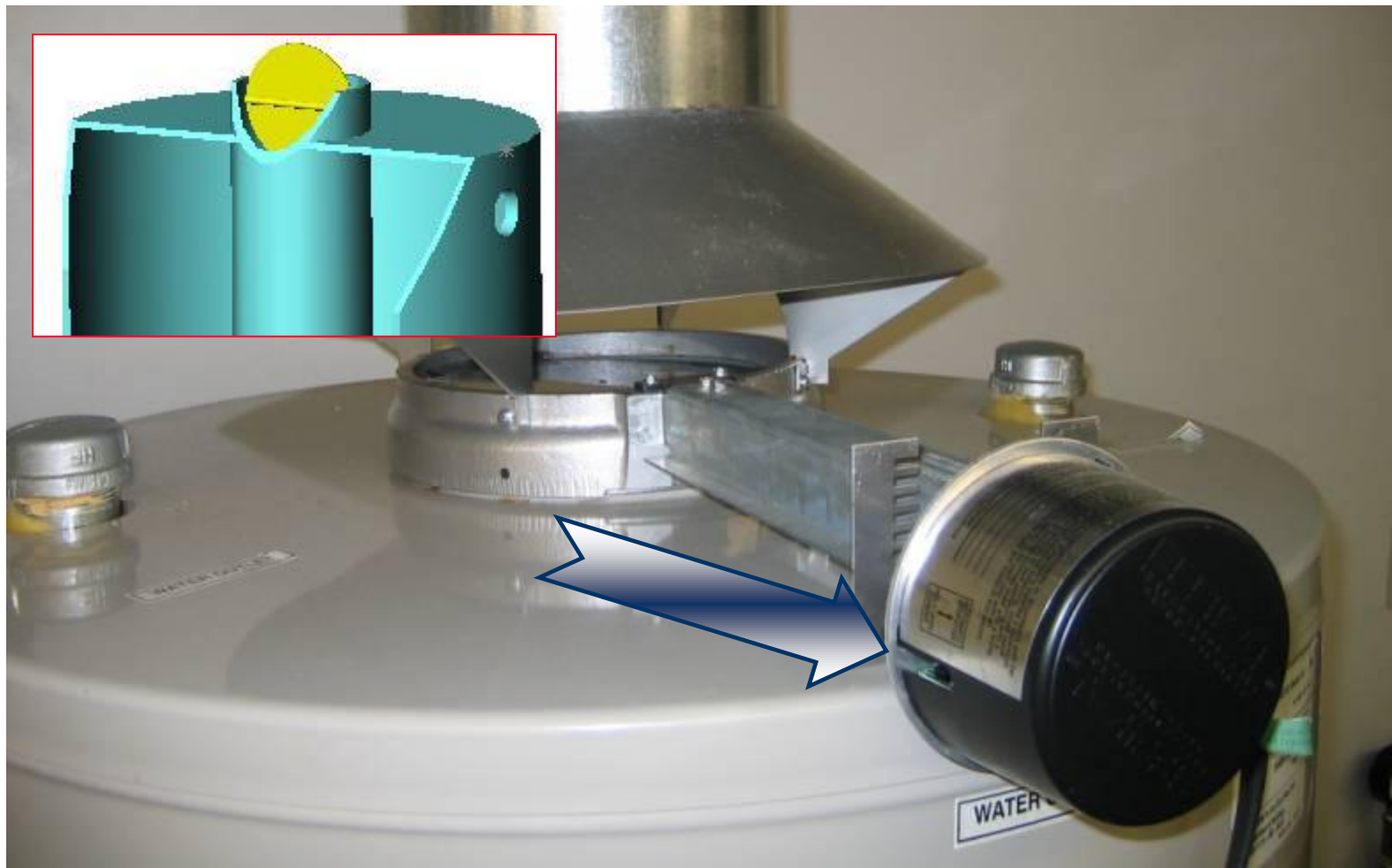
4 Hot Water Heater “Must-Do’s”



Insulate all accessible hot water lines.
Example savings: \$300 a year

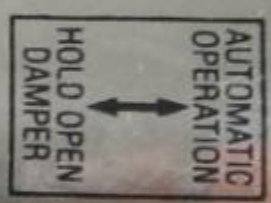


Turn on the automatic damper control.
Example savings: \$200 a year



Qualified installer in accordance with the
instructions. Improperly installed, could result
in carbon monoxide poisoning, could result
in a fire. Use only with a chimney or vent
complying with a listing agency. To be used
only in concrete chimney lined with a lining
agency. To be used only with an
agency. To be used only with an
agency. To be used only with an

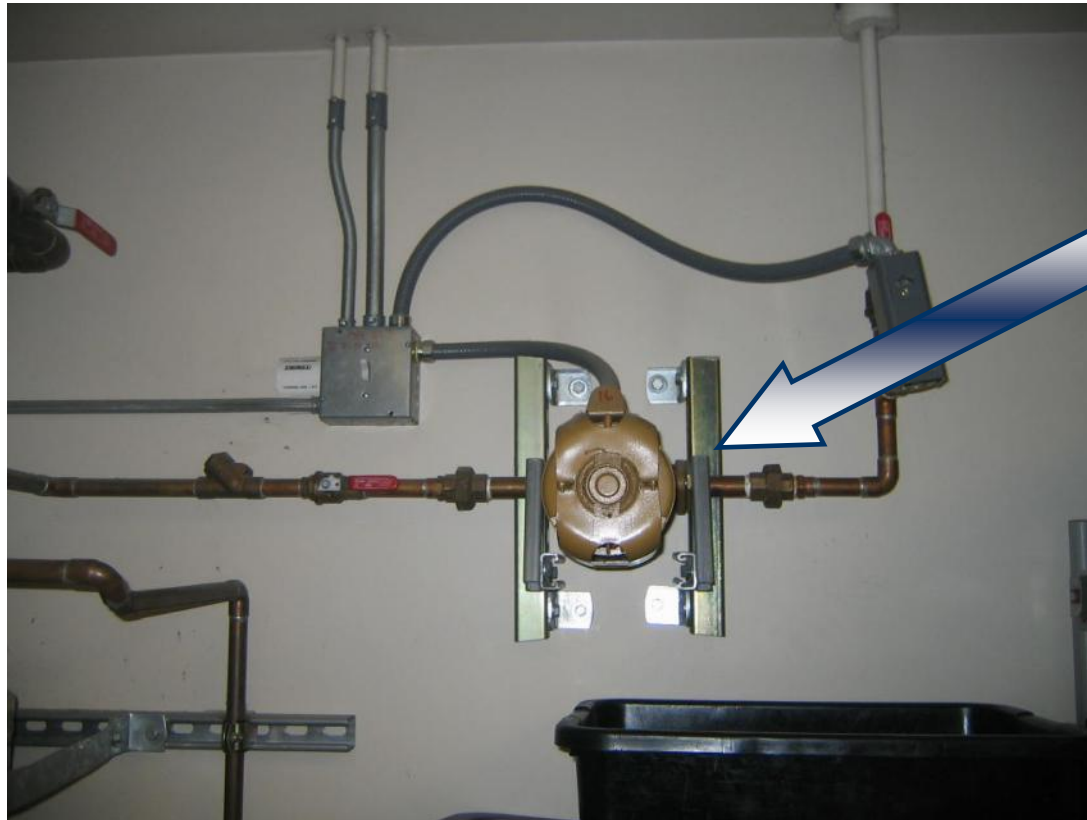
Balance-Damper
is recommended.



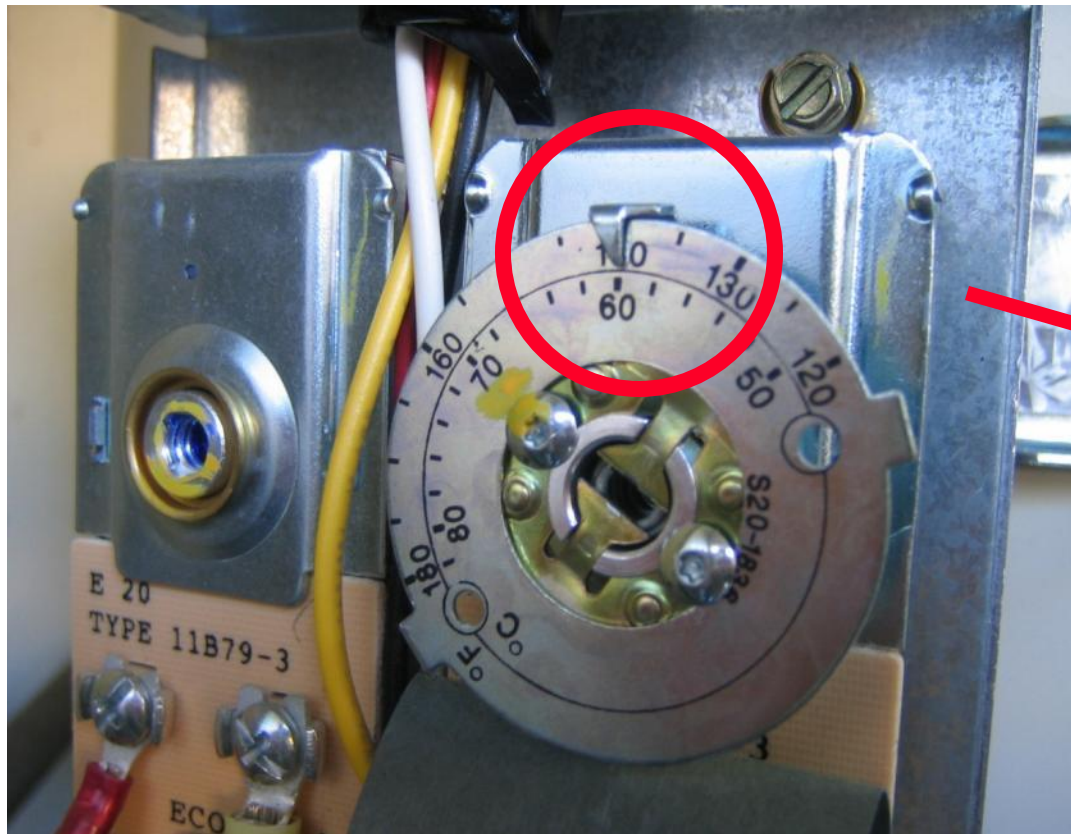
Model
Set
Date

Control the recirculation pump: use a timer to turn it off for 10 h at night.

Example savings: \$700 a year

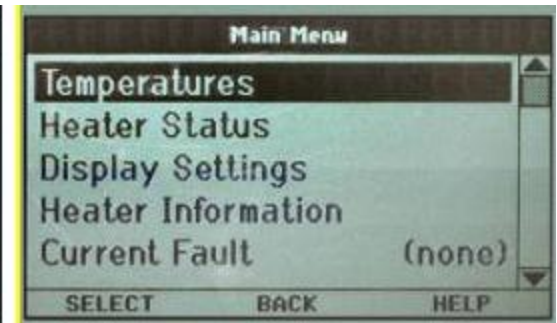
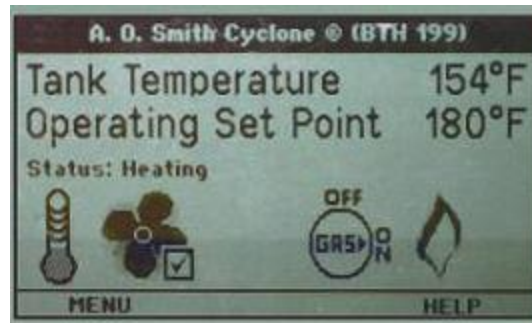


Regulate the tank temperature
by properly setting the thermostat.
Example savings: \$600 a year for 5°F turndown



Intelligent Water Heaters?

- Easy to read and accurate thermostats are needed
- Condensing water heaters with central processing units



Water Heating System Efficiency Strategies:

- Higher efficiency (condensing) water heater
- Increase distribution efficiencies (recirculation pump control time clock, insulation, optimized piping layout)
- High efficiency (condensing) tankless heater
- High efficiency (condensing) boiler
- Refrigerant heat recovery
- Waste water heat recovery
- Exhaust air-to-water heat recovery
- Appliance flue gas-to-water heat recovery
- Solar preheating



Refrigerant [Desuperheater] Heat Recovery



Therma-Stor

Mueller Fre-Heater



Dish Machines





Specify Energy Star Dish Machines!

protect the environment through superior energy efficiency. [Learn more...](#)

www.energystar.gov/cfs



Refrigeration



Holding Cabinets



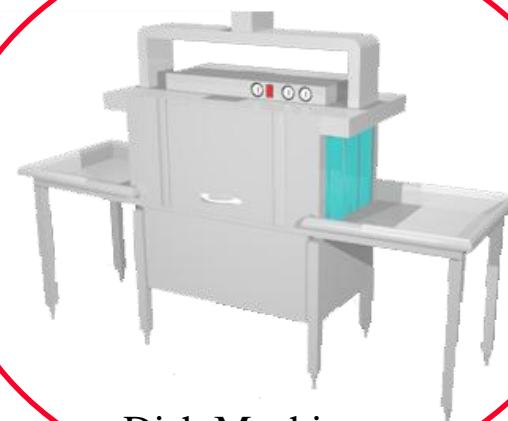
Steamers



Ice Machines



Fryers



Dish Machines

Dishmachines with Integrated Heat Recovery

Conveyor:

HOBART



Electrolux

Champion®

Door Type:

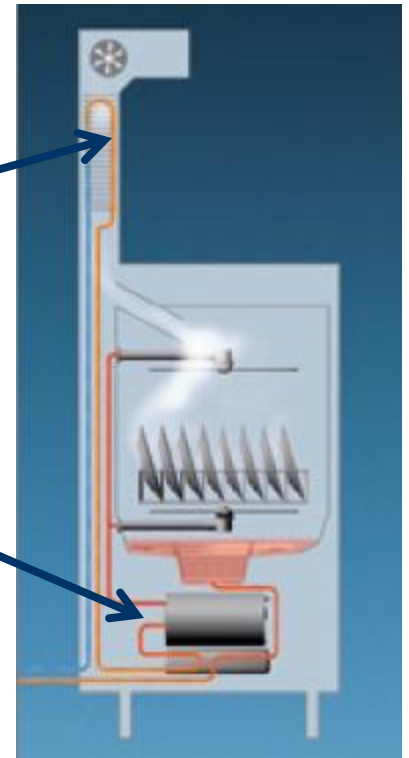
HOBART

winterhalter

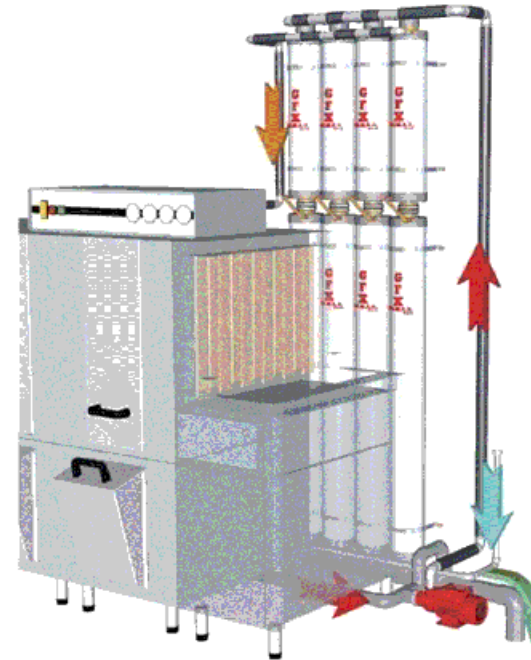
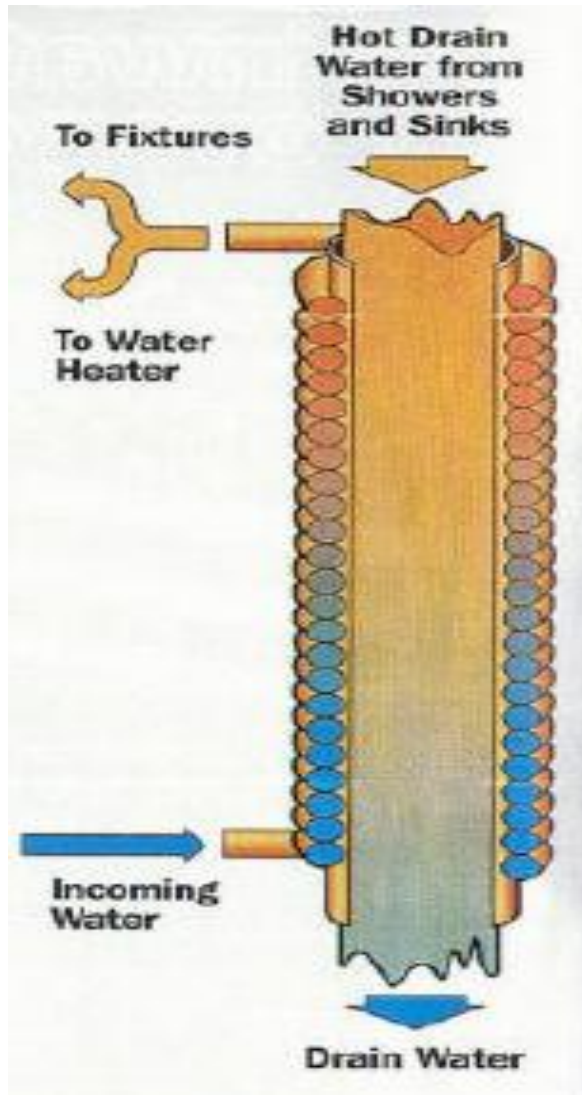






Waste Air
HR

Drain
Water
HR



Drain Heat Recovery ???



-  Cold Fresh Water Supply to GFX Wall
-  Warm Drainwater from Dishwasher to GFX Wall
-  Pre-Heated Fresh Water Supply from GFX Wall to Dishwasher
-  Cooled Drainwater Discharge from GFX Wall to Drain

GFX Cooling Wall Features:

- Model: M4 x 1-1/2 Tier G3-30/60
- Nominal Operating Specification:
 - Energy Recovery Drainwater Capacity: 7.15 gpm
 - Energy Recovery Effectiveness: 71%
 - Total Clean Water Supply Flow Rate: 7.15 gpm
 - Coil to Drain Flow Ratio: 100%
 - Equivalent Reclaimed Thermal Power: 74 Kw
- Overall Dimensions: 2.45 x 0.75 x 0.2 m.
- Automatic Drainwater Bypass with Pump Off
- Manual and Flow Switch Pump Control

Designed by:	Checked by:	Approved by - Date:	File Name	Date:	Scale
			BEIRUT MARRIOTT HOTEL PROJECT		
			Dishwasher GFX Energy Recycling Wall		
Drawing #:	Edition	Sheet	1/1		



EXCHANGER NVX-2060

A custom-made heat exchanger for your dishwasher

- Patented, double-wall heat exchanger
- Certified performance providing up to 50% recovery
- Display screen showing savings, equipped with a touch interface
- Made of stainless steel
- Electronic control unit

[Download the technical specifications](#)

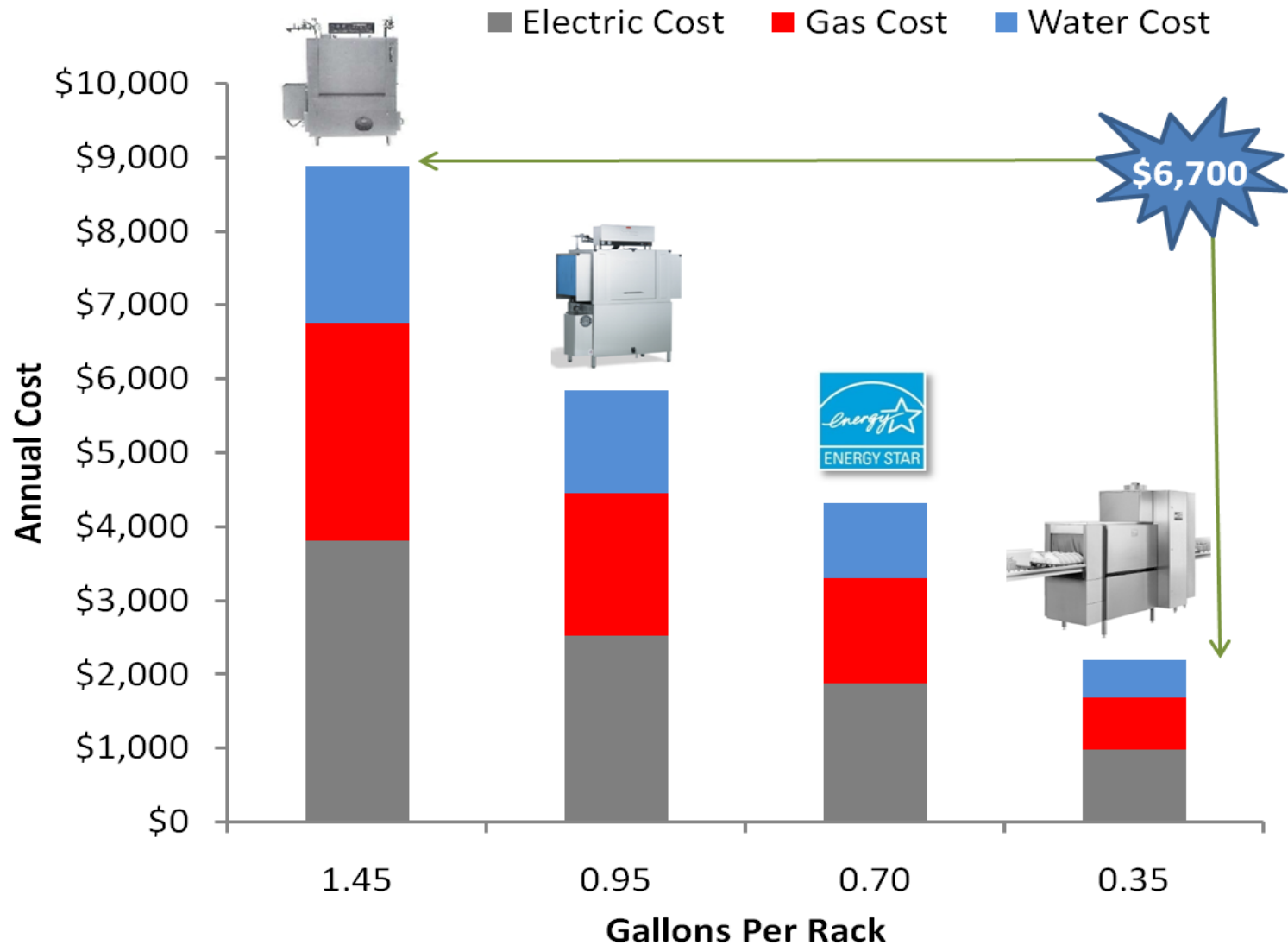
[Download the warranty](#)



NVX2060 Dishwasher Heat Exchanger NRA Kitchen Innovations 2014 Award

Novothermic's NVX2060 Dishwasher Heat Exchanger has just been selected among the recipients of the National Restaurant Association's Kitchen Innovation Awards 2014, which recognizes cutting-edge advancements in kitchen equipment for the food service industry.

Operating Cost Comparison



Install Low Flow
Pre-Rinse Spray Nozzles -
The Real Workhorse in the Dish Room!



These guys won't even turn off!



A close-up photograph of a brass faucet on a sink. The faucet is leaking water from the spout. A green hose is connected to the side of the faucet. The background is a light-colored, textured surface.

Fix All Leaks

&

Manage Water

Use!

Not so Innocent

Even a small drip adds up:

- 50,000 gallons/yr
- water/sewer: \$330
- gas: \$640
- **Total: \$970!**



\$1.20/therm gas & \$5.00 per unit water/sewer

Regulate Dipper Wells

Typical Flow Rate:

- 0.13 gpm
- 51,246 gal/yr
- water/sewer:
\$340

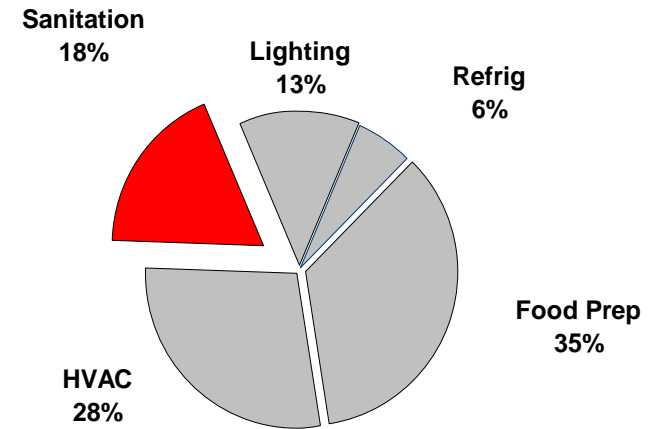


Coffee Chain removes a water waster!



Recap...

- Reduce Hot Water Use
 - Spec Energy Star dishwashers
 - Low flow pre-rinse valves
- Increase Water Heating System Efficiency
 - Higher efficiency [condensing] water heaters (tank type or tankless)
 - Distribution efficiencies (re-circulation pump control, insulation, optimized plumbing)



Design Guides

Saving hot water through innovative design strategies!

Design Guide

Improving Commercial Kitchen Hot Water System Performance

Energy Efficient Heating, Delivery and Use

This design guide provides information that will help achieve superior performance and energy efficiency in commercial water heating systems. The information presented is applicable to new construction and, in many instances, retrofit construction. The target audience consists of kitchen designers, mechanical engineers and contractors, code officials, food service operators, property managers, plumbing professionals and maintenance personnel.

This guide reviews the fundamentals of commercial water heating and describes the design process from the perspective of application. It concludes with real-world design examples, illustrating the potential for high performance, energy and water efficient systems. It is a supplemental guideline that complements current design practices (ASHRAE Handbook 2007) and codes.

Introduction and Background	1
Hot Water System Fundamentals	3
Design Path For Savings	3
Equipment and Fittings	5
Distribution Systems	11
Water Heater Selection	18
Top 10 Design Tips	32
Water Preheating	33
Conclusion	34
Example 1 FSR Design Scenarios	38
Example 2 QSR Delivery Systems	43

Introduction

This document guides the restaurant designer or engineer to use innovative design strategies that will deliver the service of hot water as efficiently as possible while meeting the increasingly challenging regulatory codes and user expectations. This is fundamentally a four-step process: (1) reducing hot water use of equipment and faucets while maintaining performance; (2) increasing the efficiency of water heaters and distribution systems; (3) improving hot water delivery performance to hand sinks; and (4) incorporating "free-heating" technologies like waste heat recovery and solar pre-heating. Through high-efficiency system design and equipment specifications, the potential exists to reduce energy use for water heating by half.

Background

Hot water is the life-blood of restaurants and other food service operations. The hot water system provides the service of hot water to clean hands, wash dishes and equipment, and for cooking purposes. For food safety reasons, restaurants are not allowed to operate without an adequate supply of hot water for sanitation. It is essential to design the water heating system to meet the needs of all the hot water using appliances under peak operation.

