

Reducing Water Use in Restaurants & Food Service Establishments

Bill Hoffman

Water Management, Inc.



512-294-7193

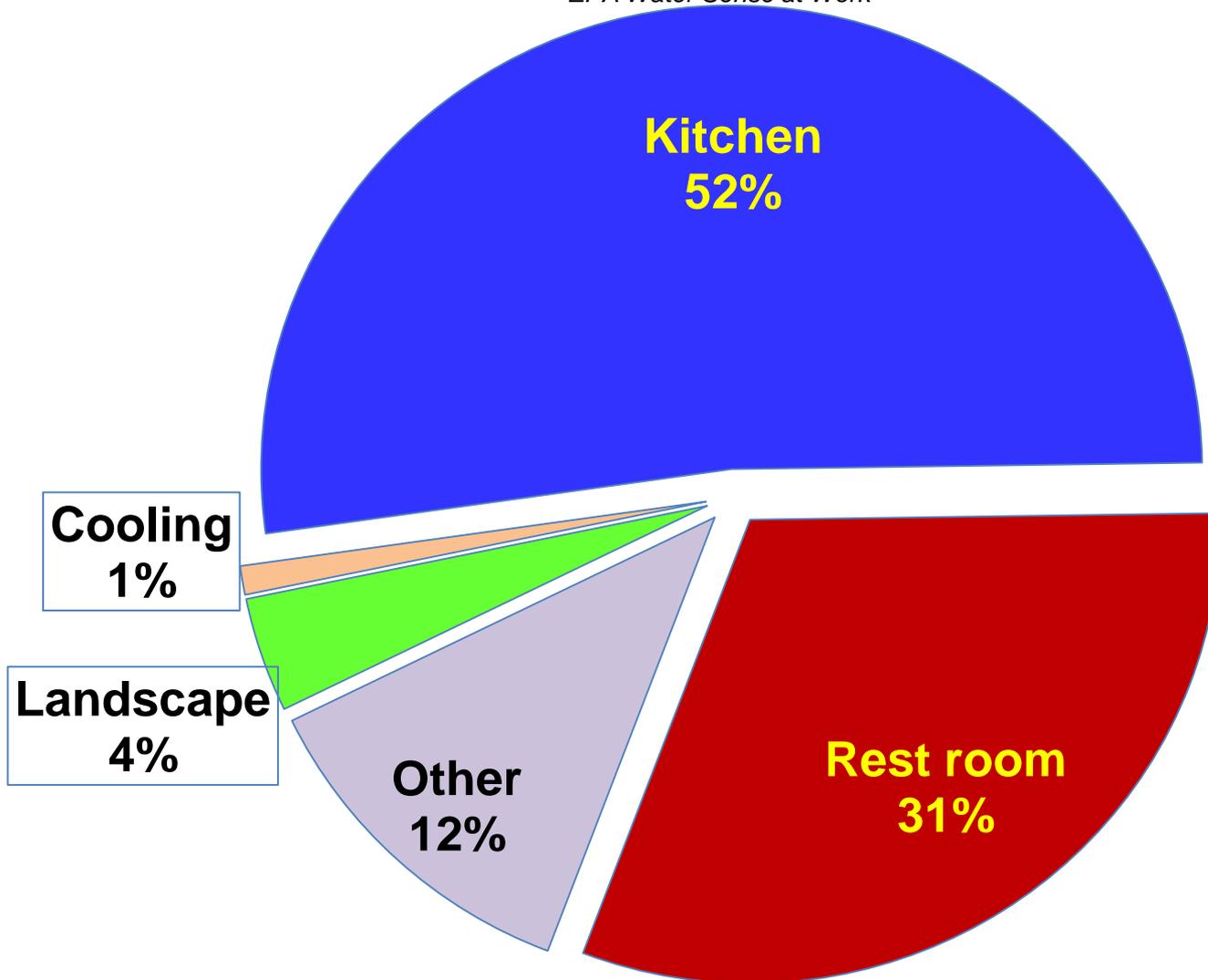
billhoffmantx@earthlink.net

Numbers of Food Service Establishments Based on Two Sets of Government Records

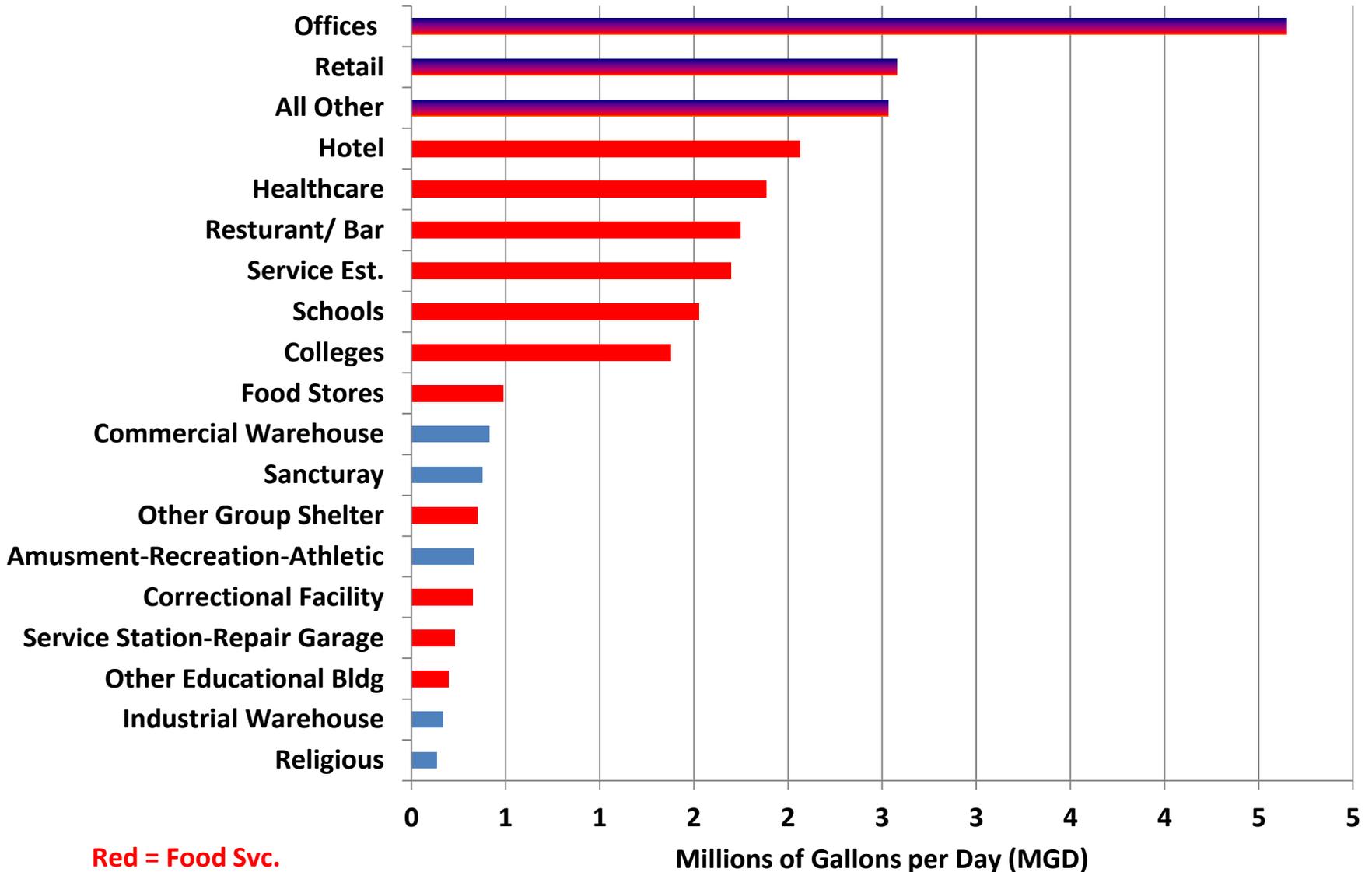
Type of Food Service	Austin/Travis Health Dept.	Austin Water Utility
Food Service	2,583	
Restaurants	1,200	1,280
Total	3,783	

Typical Water Use in Restaurants

EPA Water Sense at Work



Water Use by Commercial/Institutional Users Austin Texas Study

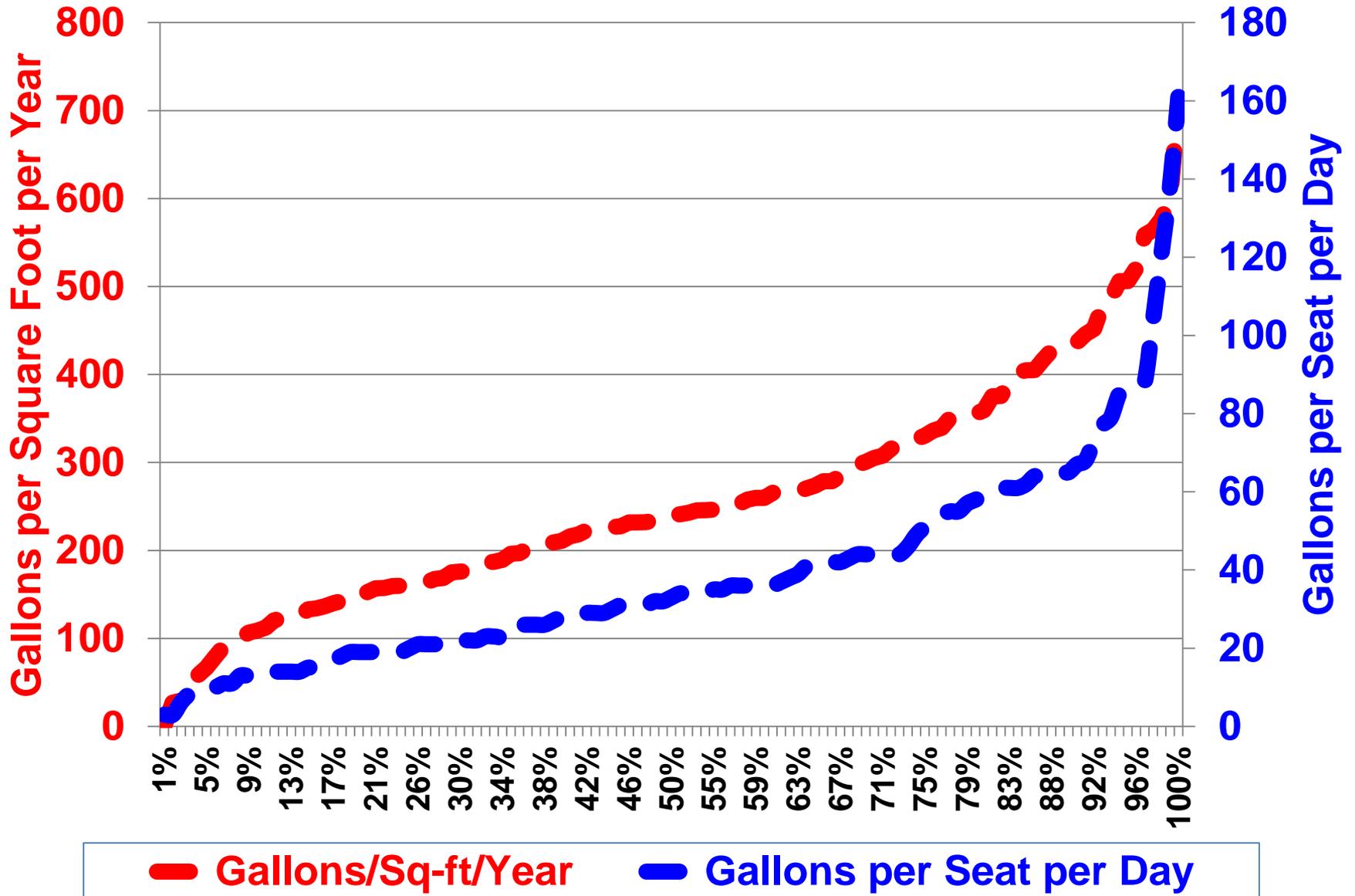


Summary of Restaurant Water Use Coefficients from Various Studies

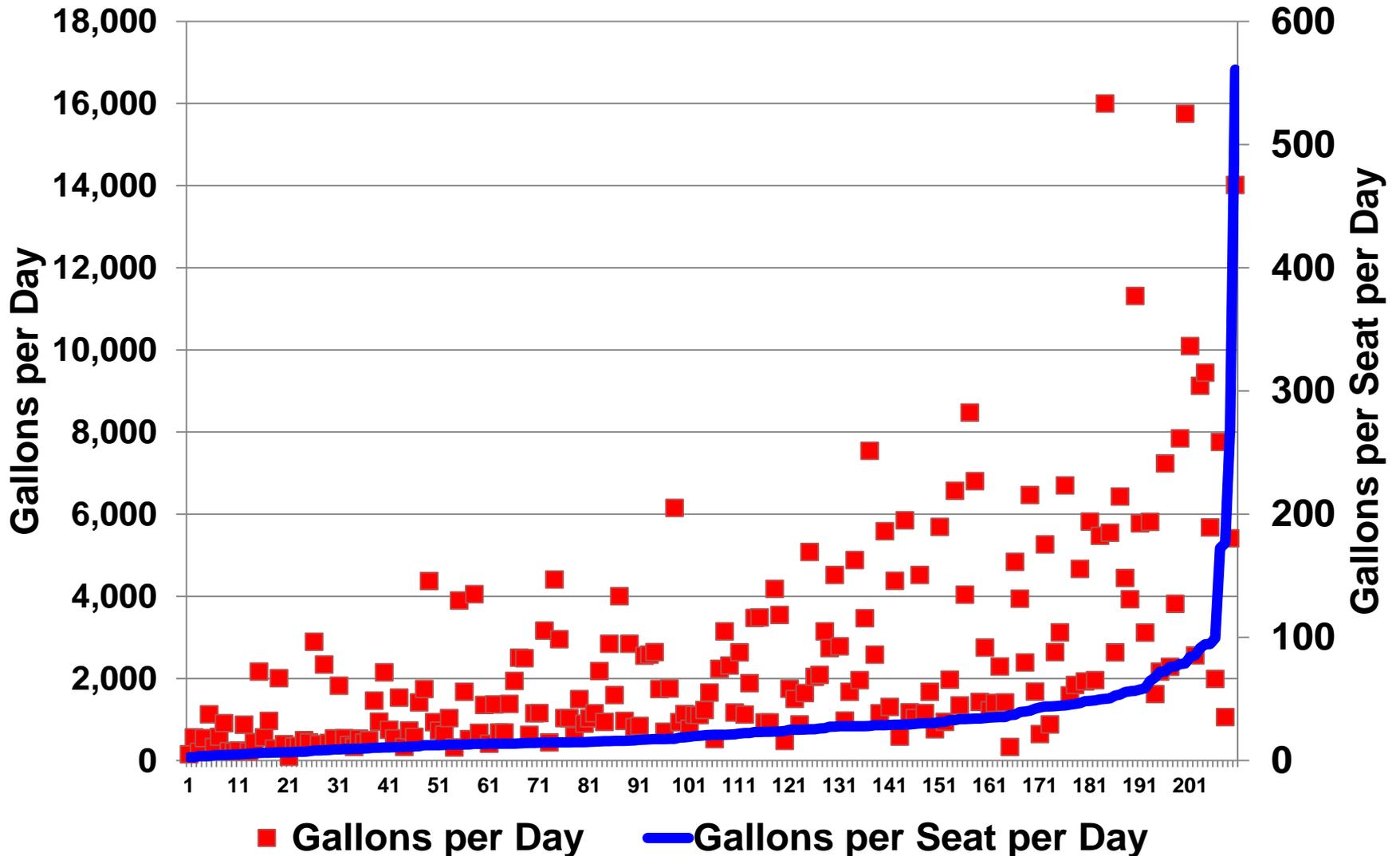
Source: H.W. (Bill) Hoffman & Associates, LLC

Source of Information	Best Gal./ Meal	Avg. Gal./ Meal	Gal./ sq. ft./ Year	Best Gal./ Seat/ Day	Avg. Gal./ Seat/ Day
Florida (Univ of Fl.) Restaurant			270		
Florida (Univ of Fl.) Fast Food			240		
Colorado Study (Brendle Group)	9 to 12		192	29	53
USA (2000 AWWARF CI End Use Study)			130 to 331	20 to 30	
Boulder Colorado	8 to 9		125		49
Danamark (Canada)					
U of Kansas (M. Vanschenkhof)		12.8	266		
South Australia study and Sydney Water		9 to 12			
North Carolina ICI BMP					20 to 40
Austin Study (Full Svc.) 2013			173		31
Austin Study (Fast Food) 2013			257		39

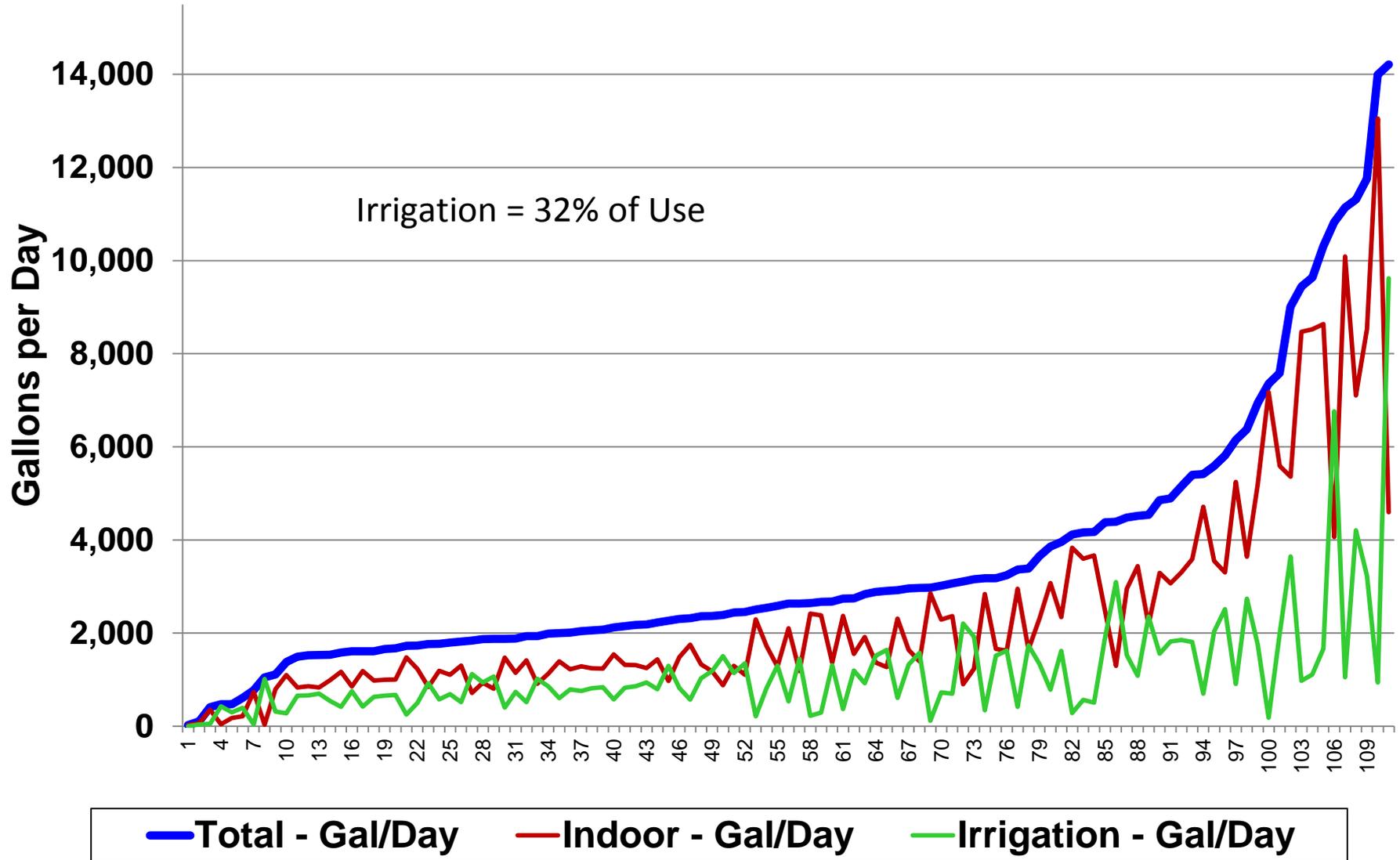
Fast Food Restaurants in Austin



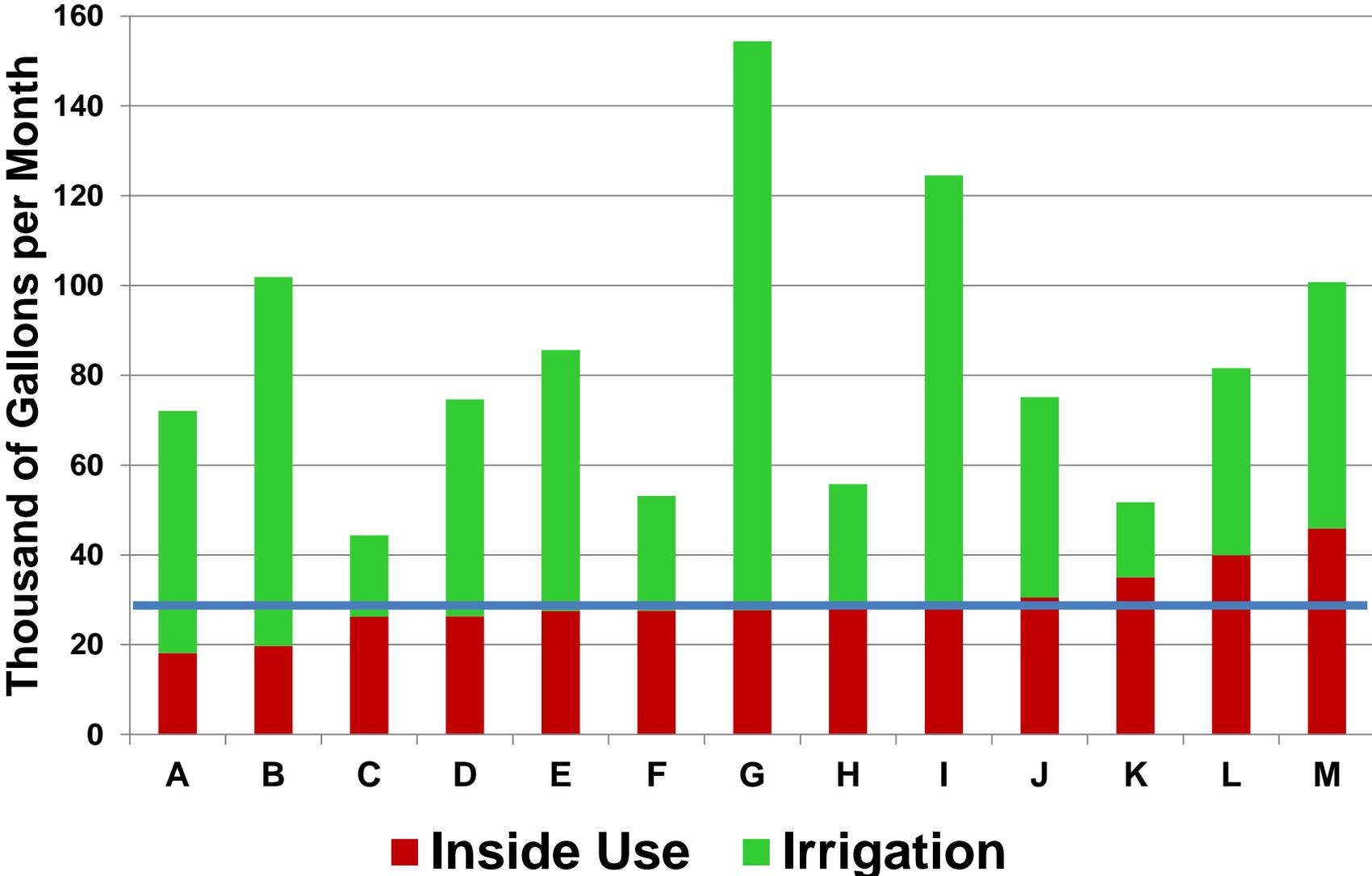
Analysis of 211 Austin Full Service Restaurants



Analysis of Daily Water Use for 111 Austin Full Service Restaurants with Separate Irrigation Meters - FY2011

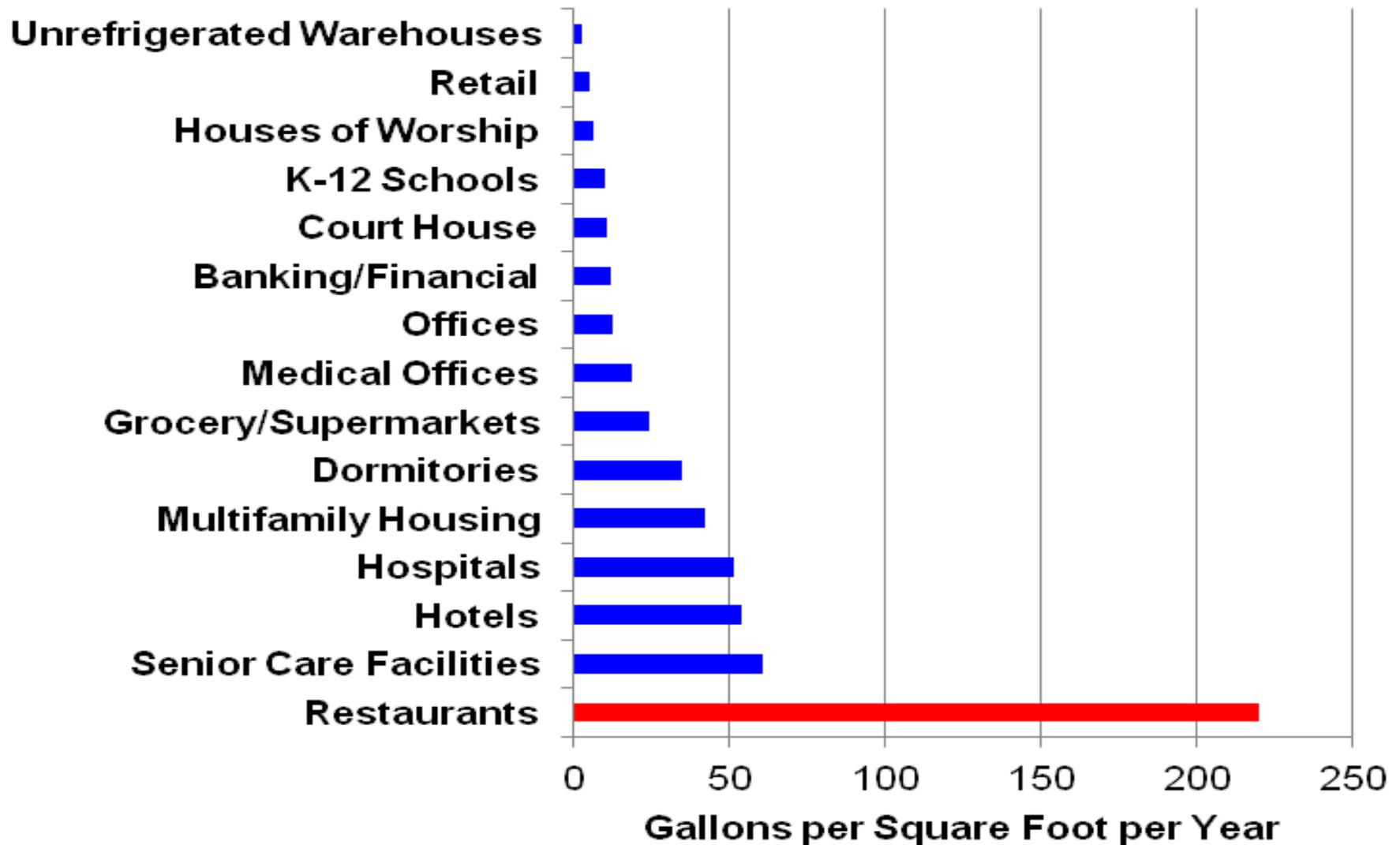


Example of Water Use 13 Almost Identical Fast Food Restaurants in the Same Chain



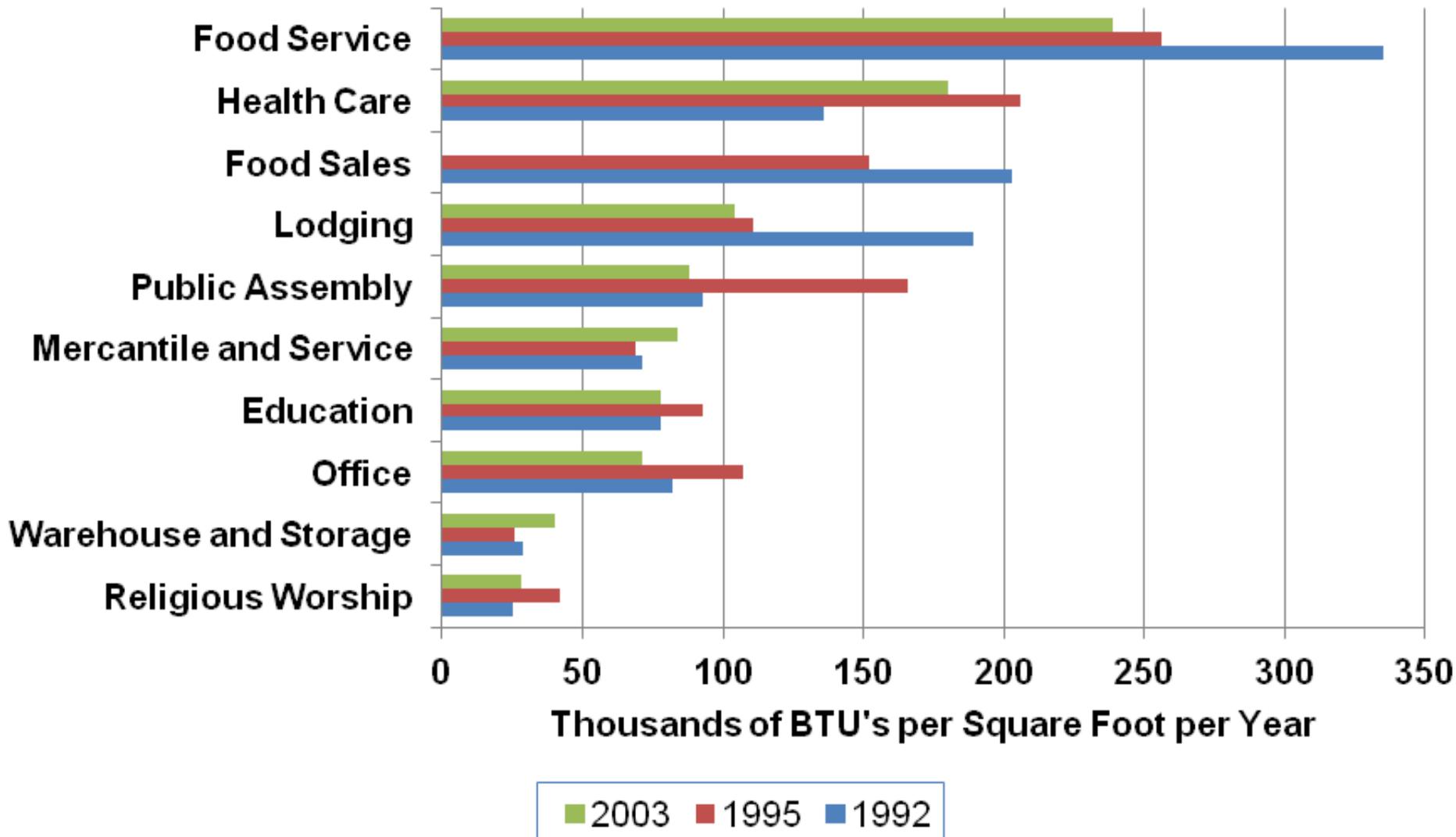
Water Use Intensity

Blue - EPA EnergyStar® Data Trends, Red - Average of Eight Studies

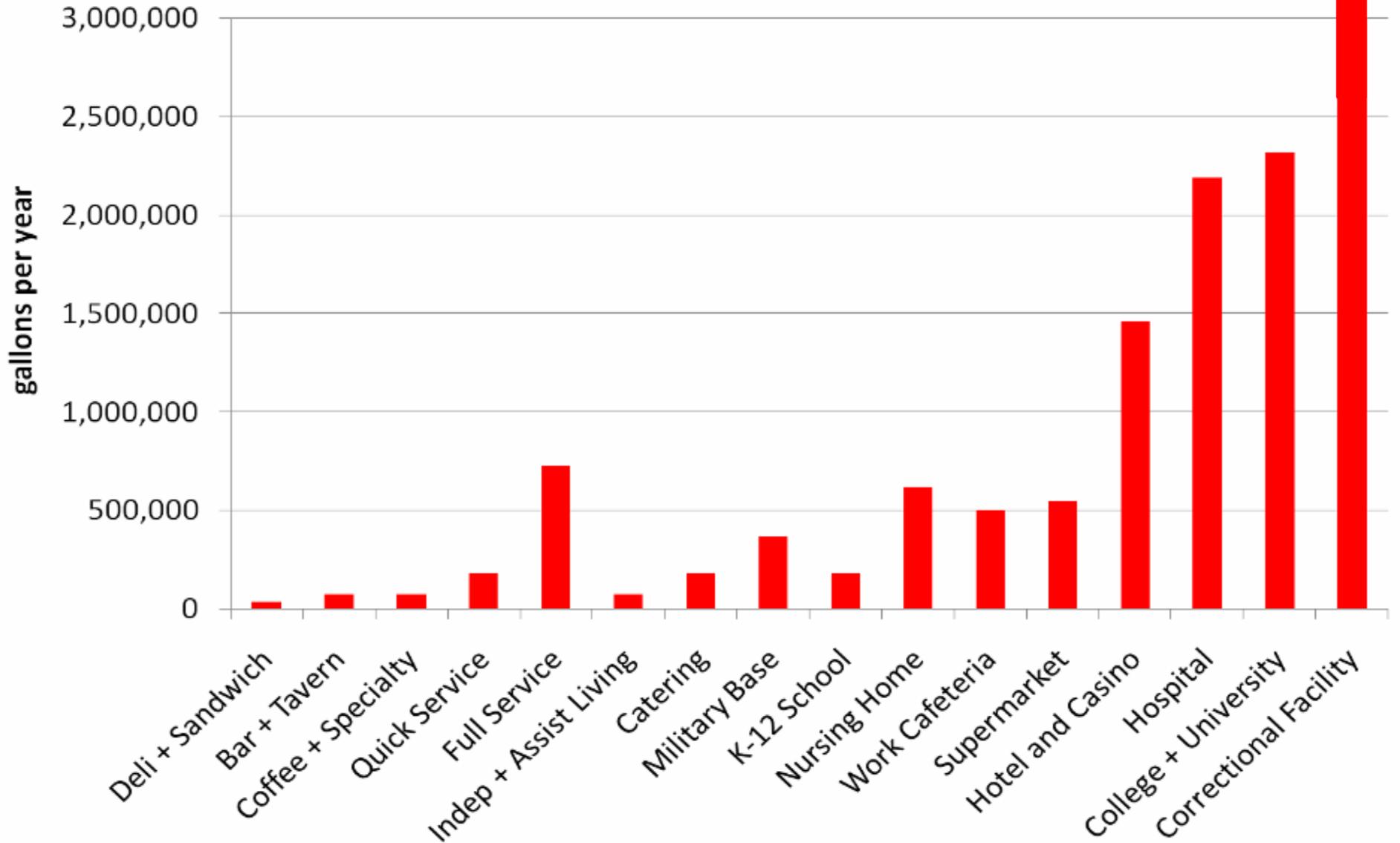


Energy Intensity for Commercial Buildings in the Western United States

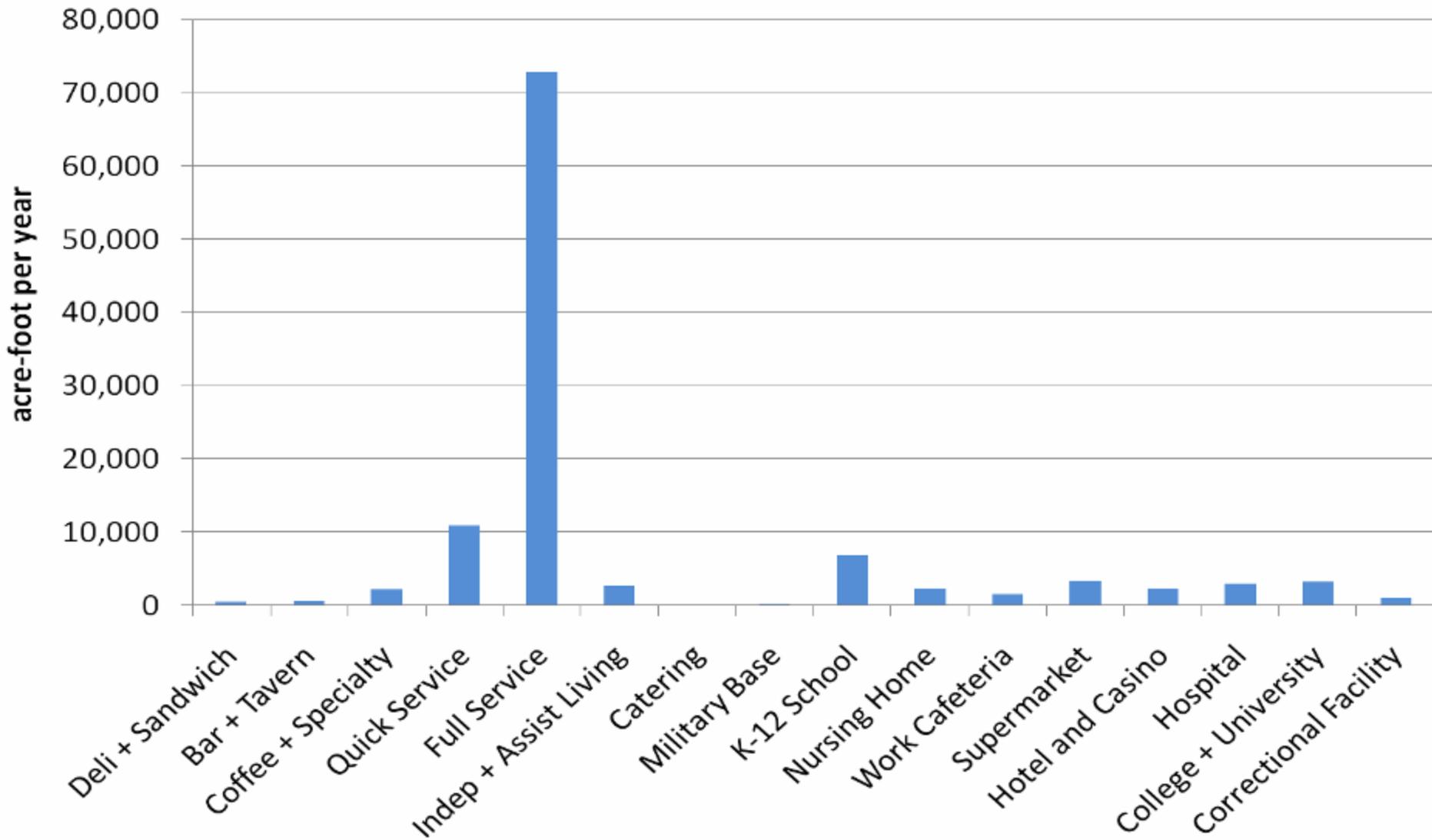
Energy Information Agency



Annual Facility Hot Water Use in California



Annual Sector Hot Water Load in California



Restaurant Hot and Cold Water Use

In full service, hot water accounts for 40% of use and 67% of the cost

In quick service, it accounts for 25% of use and 43% of the operating cost

In coffee shops, it accounts for 20% of water use and 34% of the cost

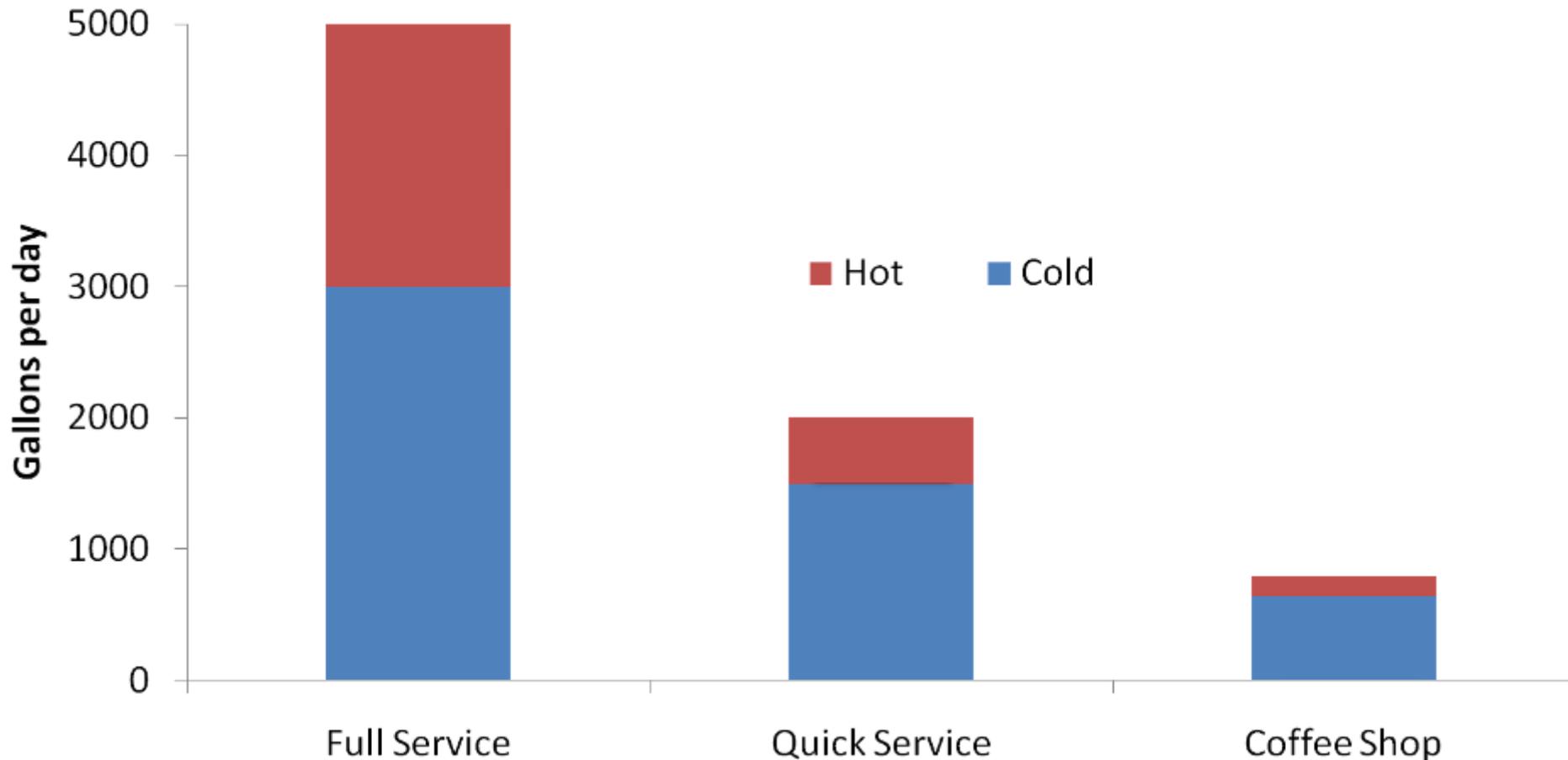


Figure 1. Energy Costs for Heating Water by 55°F

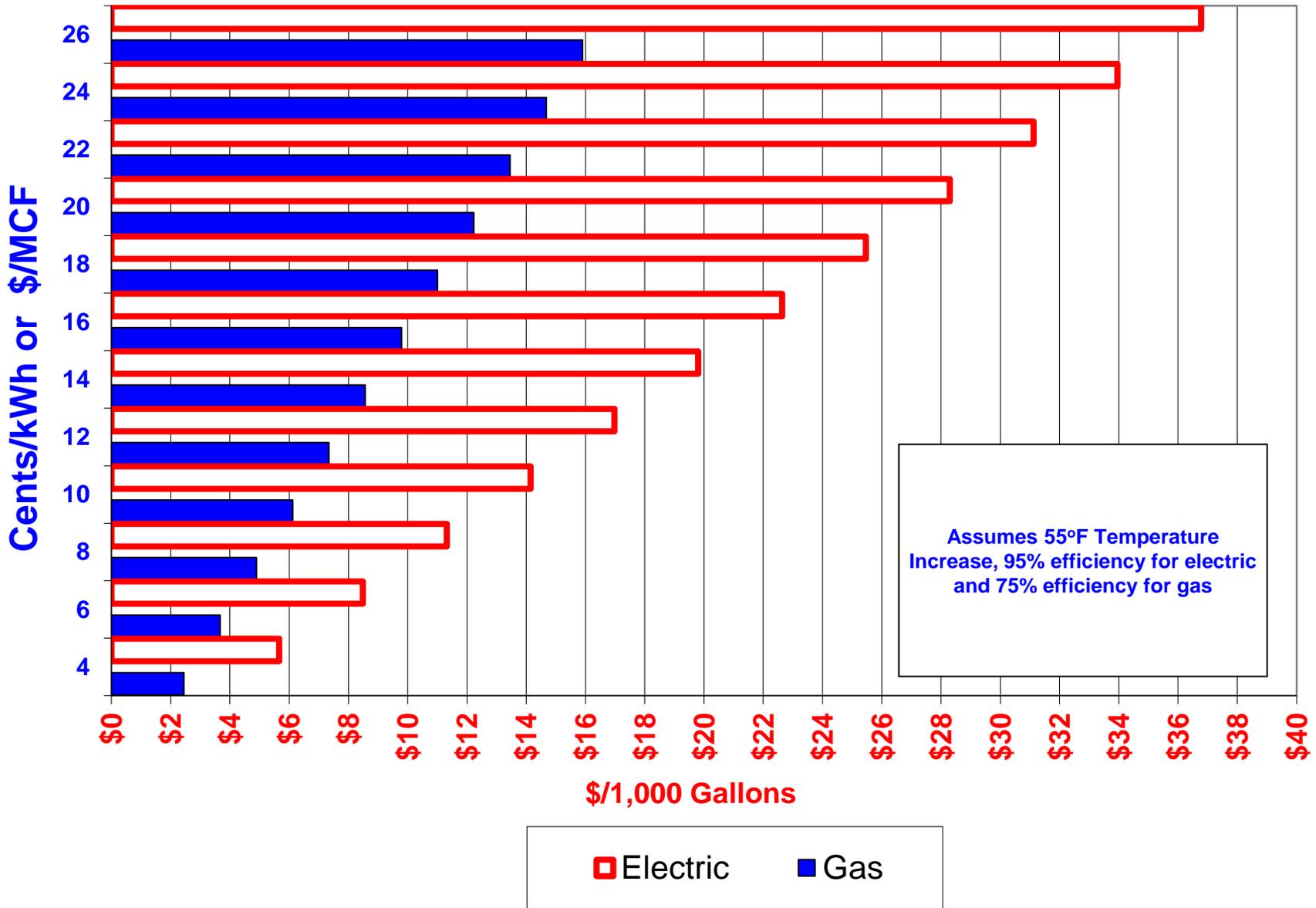
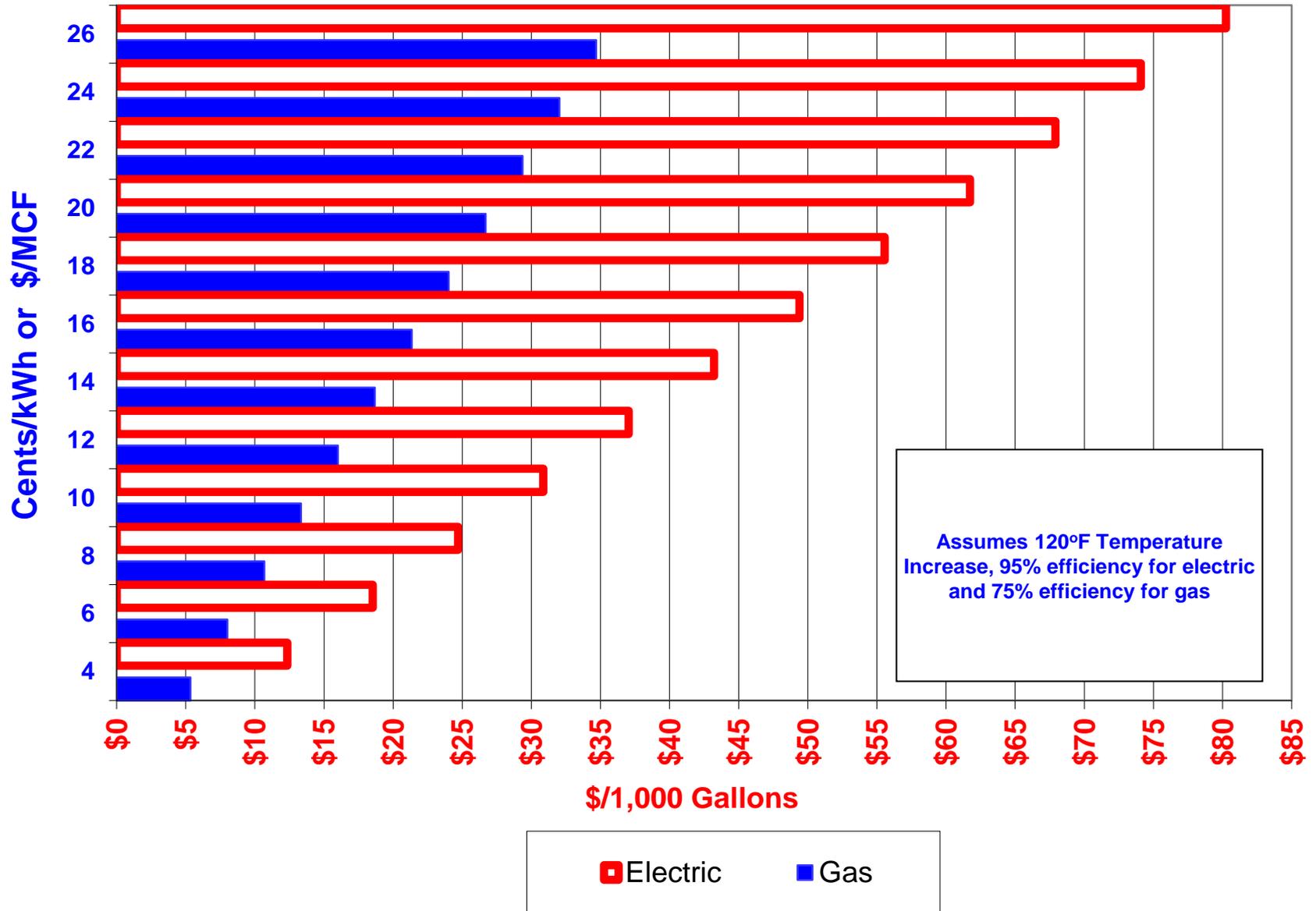


Figure 2. Energy Costs for Heating Water by 120°F



Pre-Rinse Spray Valves



More water
Less pressure



Forceful
Spray

Old Spray Valve

- ❖ 4.5 GPM
- ❖ 5.6 – 9.7 ¢/Min.
Gas or Elec.

New Spray Valve

- ❖ 1.28 GPM
- ❖ 1.6 – 2.8 ¢/Min.
- ❖ Gas or Elec.

Dollars per Year for Toilet Flushing

\$13.12/1,000 gallons

Gallons per Flush	Cents per Flush	Type of Facility		
		Home 6 flushes per day	Office 35 flushes per day	Restaurant 75 flushes per day
5	6.6	\$144	\$838	\$1,796
3.5	4.6	\$101	\$587	\$1,257
1.6	2.1	\$46	\$268	\$575
1.28	1.7	\$37	\$215	\$460



Air cooled ice machine

Water cooled ice machine
(no louvers)

[Jump to first page](#)

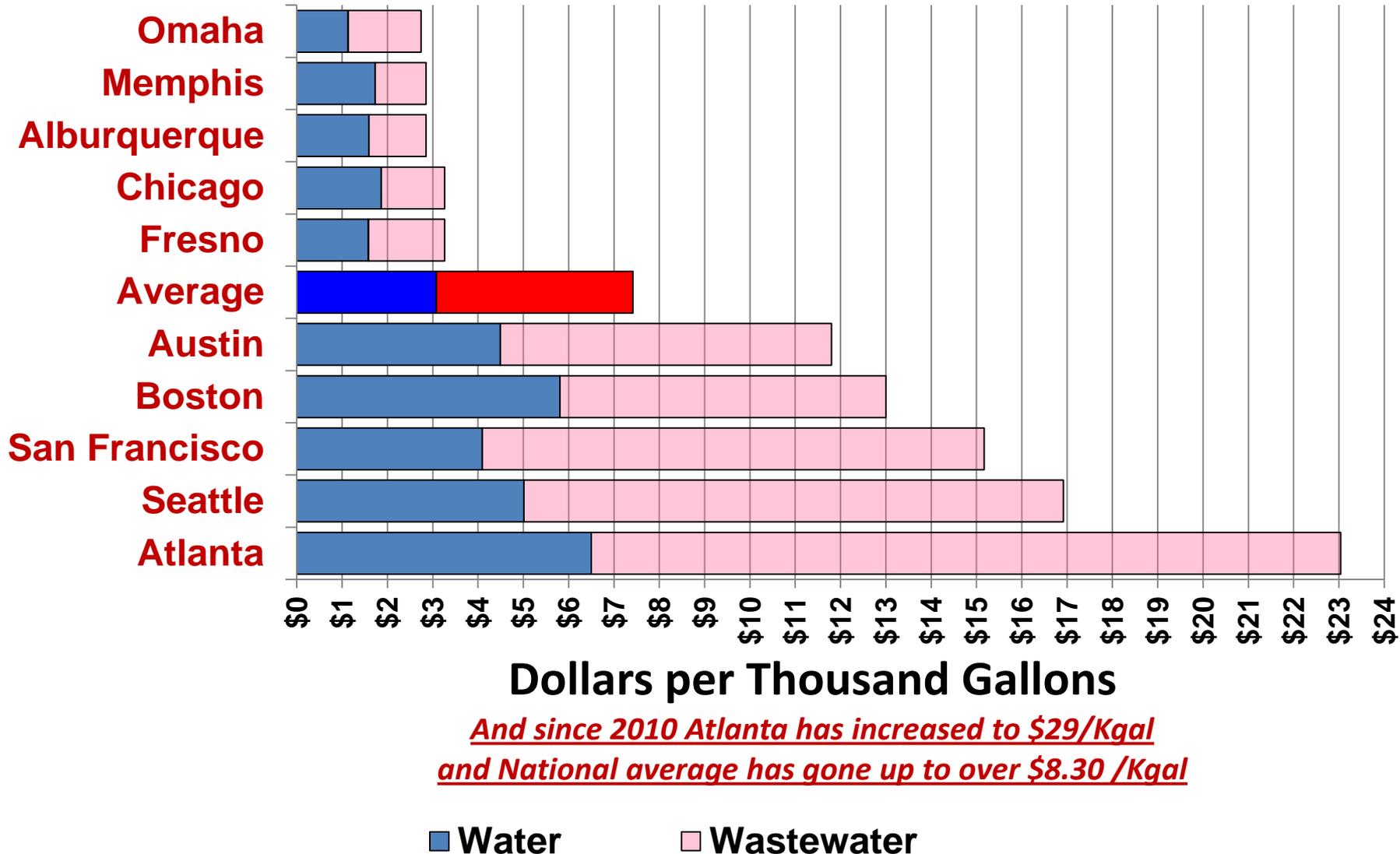


Generalized Energy Recommendations from DOE for Ice Machines Used at Federal Facilities

Machine Capacity in Pounds of Ice Produced per Day	Kilowatt Hours for Air Cooled Machines	Kilowatt Hours for Water Cooled Machines	Difference	Energy Cost Savings (Cents per 100 pounds of ice @ 10)
500 to 750	<5.5	<4.1	1.4	14
750 to 1500	<5.0	<3.5	1.5	15
1500 up	<4.6	<3.4	1.2	12
Average Savings per 100 Pounds of Ice Based on Electricity at 10 Cents per kWh				13.7

2010 Commercial Water and Wastewater Rates for Five Lowest and Five Highest Cities in the USA

Source: www.reap-ks.org/images/content/files/2010BVstudy.pdf

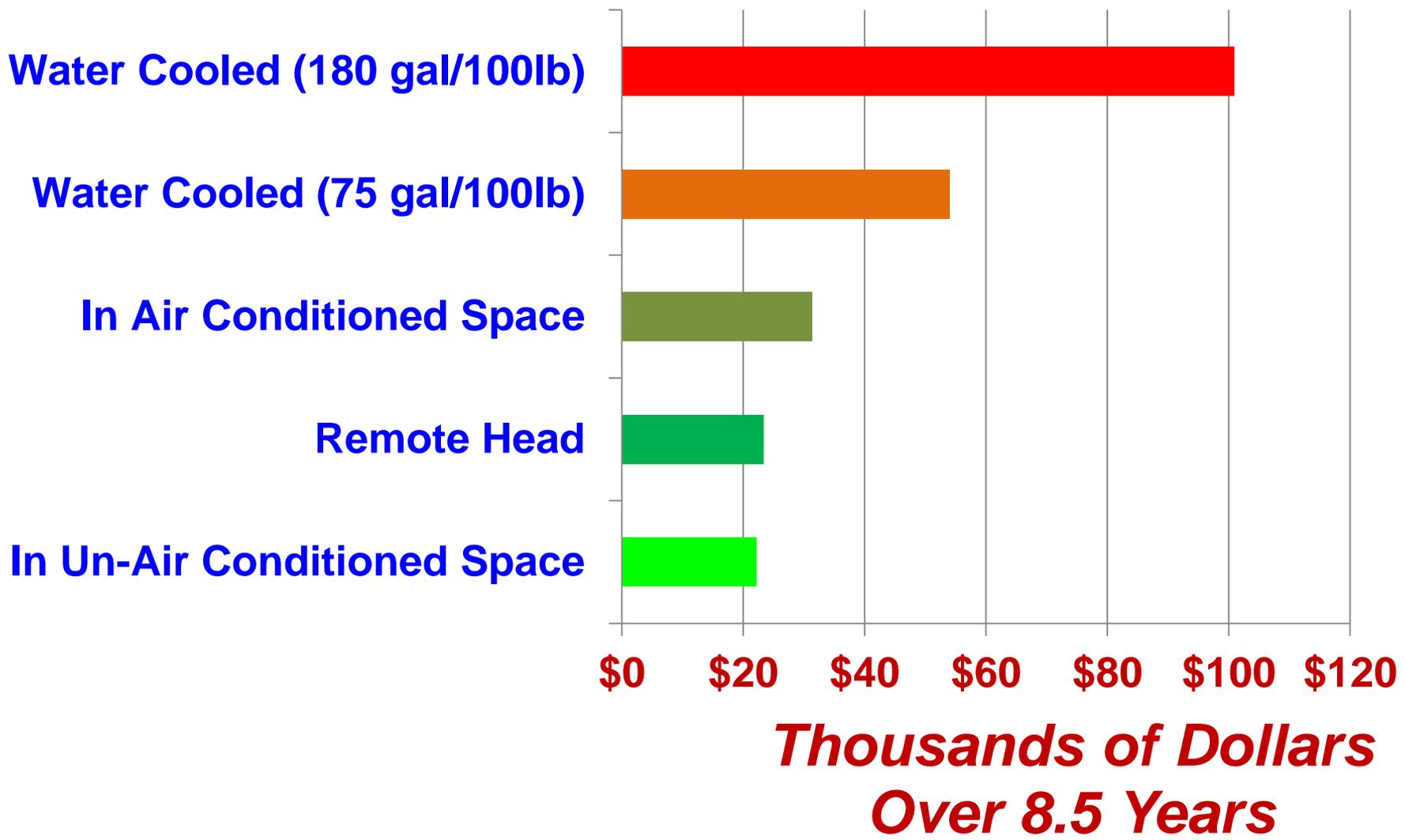


Air Cooled Cost Savings Using DOE Latest Recommended Energy Standards for Ice Machines

At a water cost of only **\$2.50/Kgal!!!!**

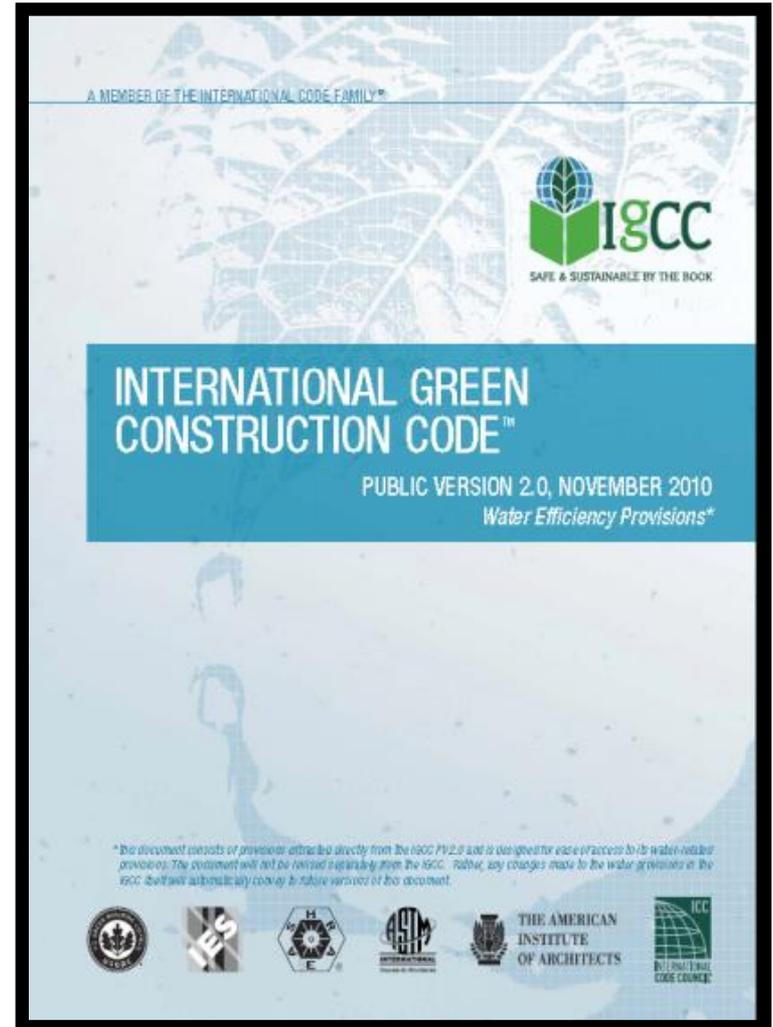
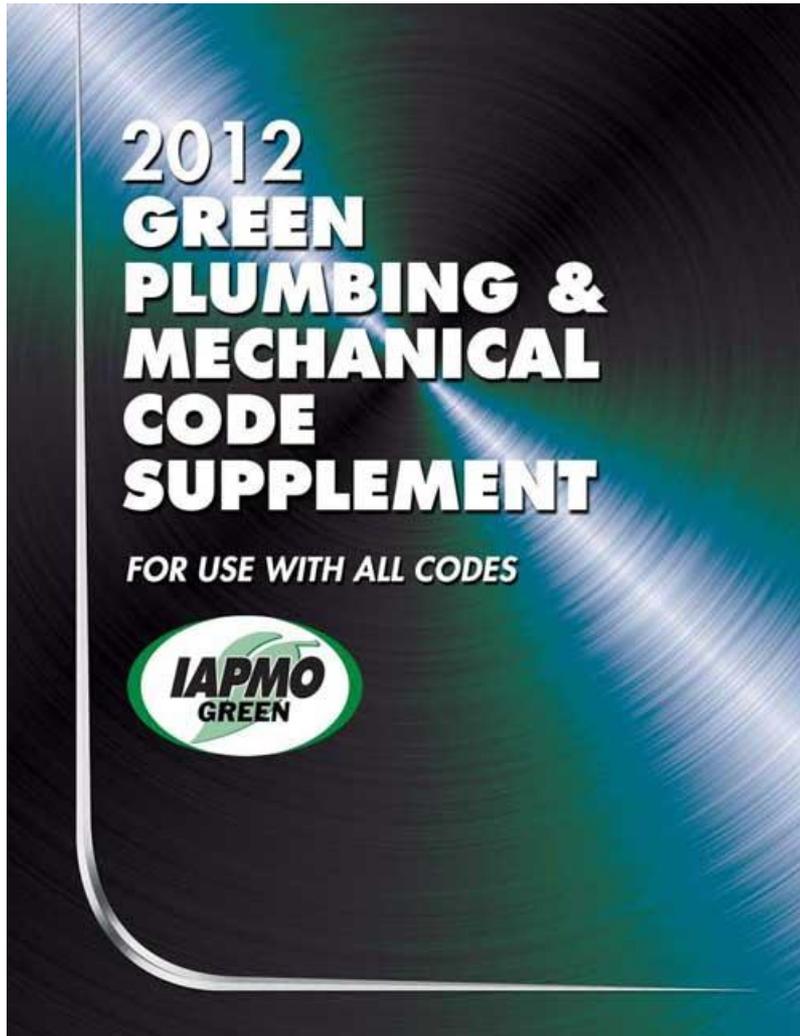
Gallons per 100 lb.	Cost of Water and Wastewater Combined \$2.50 per kGal (Cents/100 Pounds)	Energy Savings per 100 Pounds With Water Cooled Equipment (Cents/100 Pounds)	Net Savings per 100 Pounds with Air Cooled Equipment (Cents/100 Pounds)
85	21.25	13.7	7.6
100	25	13.7	11.3
150	37.5	13.7	23.8
200	50.0	13.7	36.3

Utility Cost of Ice Machines Making 1,000 Pounds a Day Over 8.5 Year Life Cycle At Austin Water, Sewer, and Electric Rates

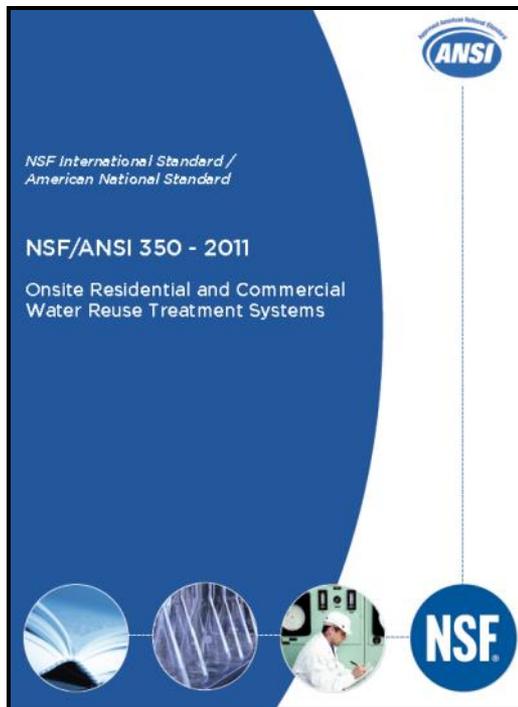


Codes,
Equipment, and
New
Developments

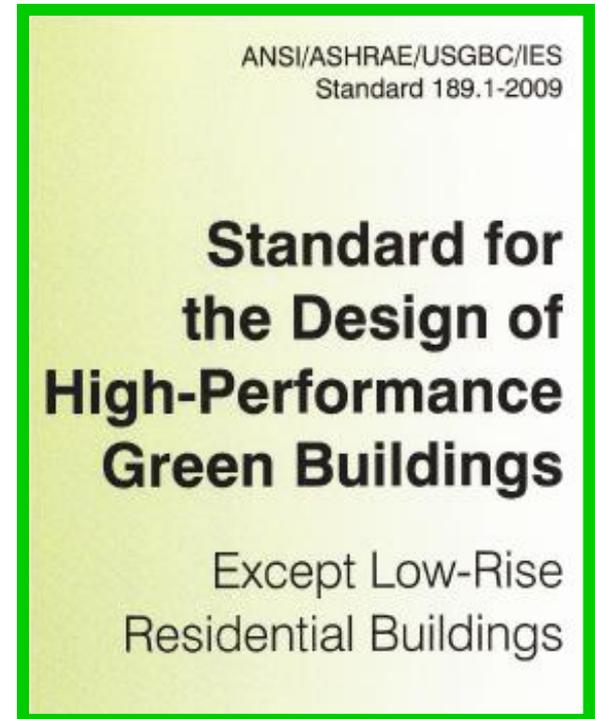
Examples of Codes



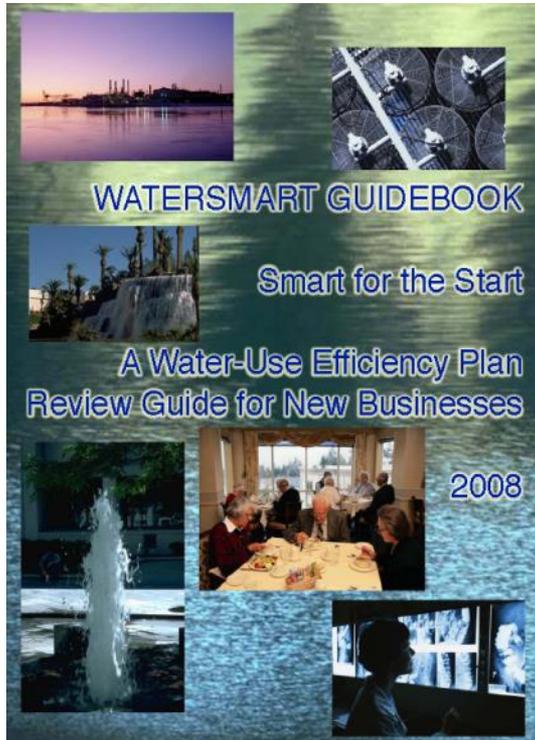
Examples of Standards



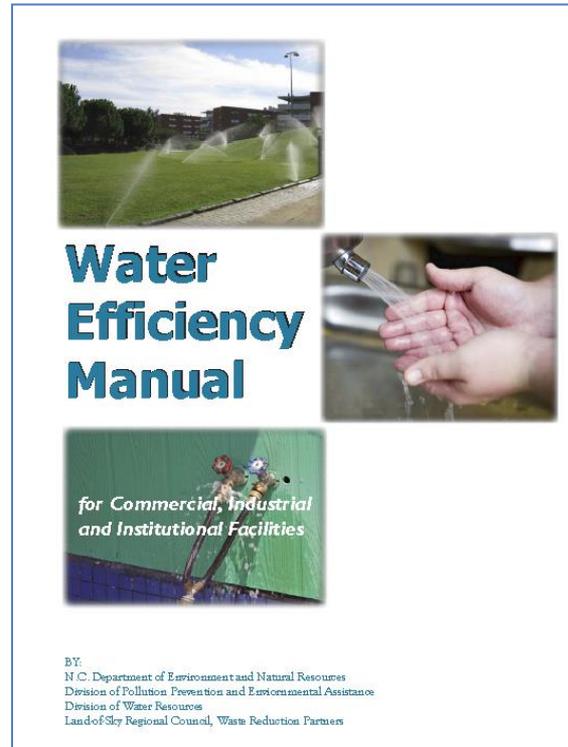
**ASHRAE
STD 191**
*Under
Development*



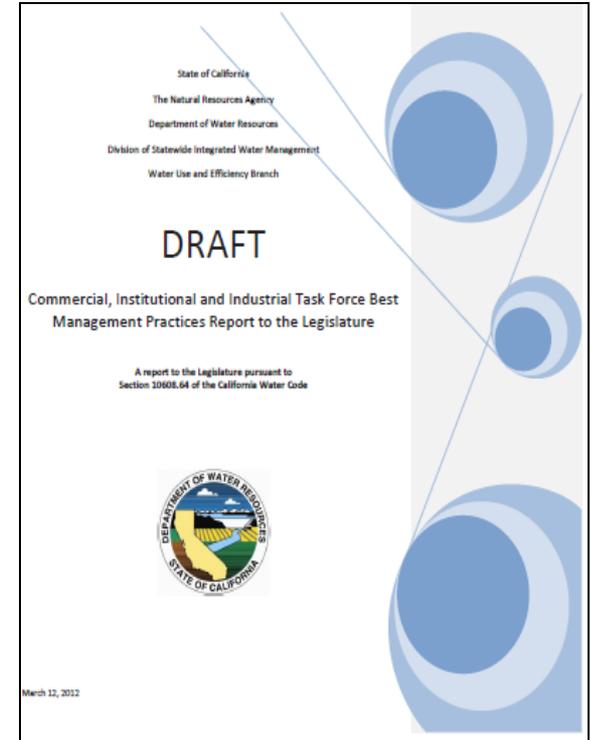
Three Must-Have Guide Books



2008



2009



2012

Texas Currently Developing BMP Guide

Energy Efficiency Requirements for Commercial Dishwashers

http://www.energystar.gov/index.cfm?c=comm_dishwashers.pr_crit_comm_dishwashers

Machine Type	High Temp Efficiency Requirements		Low Temp Efficiency Requirements	
	Idle Energy Rate*	Water Consumption**	Idle Energy Rate*	Water Consumption**
Under Counter	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR
Stationary Single Tank Door	≤ 0.70 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR
Pot, Pan, and Utensil	≤ 1.20 kW	≤ 0.58 GPSF	≤ 1.00 kW	≤ 0.58 GPSF
Single Tank Conveyor	≤ 1.50 kW	≤ 0.70 GPR	≤ 1.50 kW	≤ 0.79 GPR
Multiple Tank Conveyor	≤ 2.25 kW	≤ 0.54 GPR	≤ 2.00 kW	≤ 0.54 GPR
Single Tank Flight Type	Reported	$GPH \leq 2.975x + 55.00$	Reported	$GPH \leq 2.975x + 55.00$
Multiple Tank Flight Type	Reported	$GPH \leq 4.96x + 17.00$	Reported	$GPH \leq 4.96x + 17.00$

July 2013 New EnergyStar® Qualifying Commercial Ware Washers

Type of Machine	Water Consumption <i>(see footnote)</i>	High Temperature Sanitizing				Chemical Sanitizing			
		High	Median	Low	Number Qualifying	High	Median	Low	Number Qualifying
<i>Multiple Tank Flight-type</i>	(GPH)	141.2	120	58.2	9	Non Listed			
<i>Single Tank Flight-type</i>	(GPH)	112	58.2	58.2	5				
<i>Pot, Pan, and Utensil</i>	(GPSF)	0.42	0.32	0.3	6				
<i>Multiple Tank Rack Conveyor</i>	(GPR)	0.53	0.38	0.39	19	0.46	0.46	0.46	2
<i>Single Tank Rack Conveyor</i>	(GPR)	0.63	0.59	0.3	29	Non Listed			
<i>Stationary Single Tank Door</i>	(GPR)	0.9	0.73	0.33	42	1.13	1.01	0.56	28
<i>All Under Counter</i>	(GPR)	0.84	0.8	0.62	28	1.14	0.74	0.74	4

GPH - Gallons per Hour,
GPSF Gallons per Square Foot,
GPR - Gallons per Rack

Summary of Qualifying Food Steamer Models Based on New June 2013 EPA EnergyStar® Standards

Range of Water Use <i>(Gallons per Hour or Use)</i>	Type of Steamer	
	Boilerless Type	Boiler Type
All Levels of Water Use	147	15
Number Over 15.1 Gallons/Hour	0	10
Number between 5.0 and 15 Gallons/Hour	0	5
Number Between 4.9 and 15.0 Gallons/Hour	0	0
Number Between 2.0 and 5.0 Gallons/Hour	13	0
Number Between 1.5 and 2.0 Gallons/Hour	2	0
Number Between 1.1 and 1.5 Gallons/Hour	122	0
Number Under 1.0 Gal/Hour	10	0

EnergyStar® rated equipment is primarily rated for energy efficiency. Some energy efficient models are now water efficient. Customers are recommended to purchase boilerless steamers using 1.5 gallons per hour or less and boiler type steamers that use 15 gallons per hour or less. Boilerless equipment should be the choice for most situations.

Summary of EPA Energy Star® Qualified Commercial Ice Machines as of July 2013

Type	Gallons per 100 Pounds of Ice Produced				
	Number Qualifying	EPA Standard	Lowest Available	Median	Highest Available
Continuous (<i>flake, nugget</i>)	57	15*	15*	15*	15*
Batch	104	20	13	19	20
Self Contained <200lb/day	39	25	20.3	21.3	25

* It takes 11.9 gallons of water to make 100 pounds of ice. The additional water shown for continuous ice makers is water that is contained in the ice produced. This water is not technically "wasted" since it is unfrozen water in the product. All use a total of about 15 gallons per 100 pounds of ice plus weight of water. Flake machines are more energy efficient than cube machines.

2013 Clothes Washer Water Factor Criteria Levels

Gallons per Cubic Foot of Washer Volume

Standard	Front Loaders	Top Loaders
EnergyStar® Residential	6.0	NONE
EnergyStar® Commercial	4.5	NONE
Federal Standard	6.5	9.5

Reducing Water Use

Scrap Basket Strainers

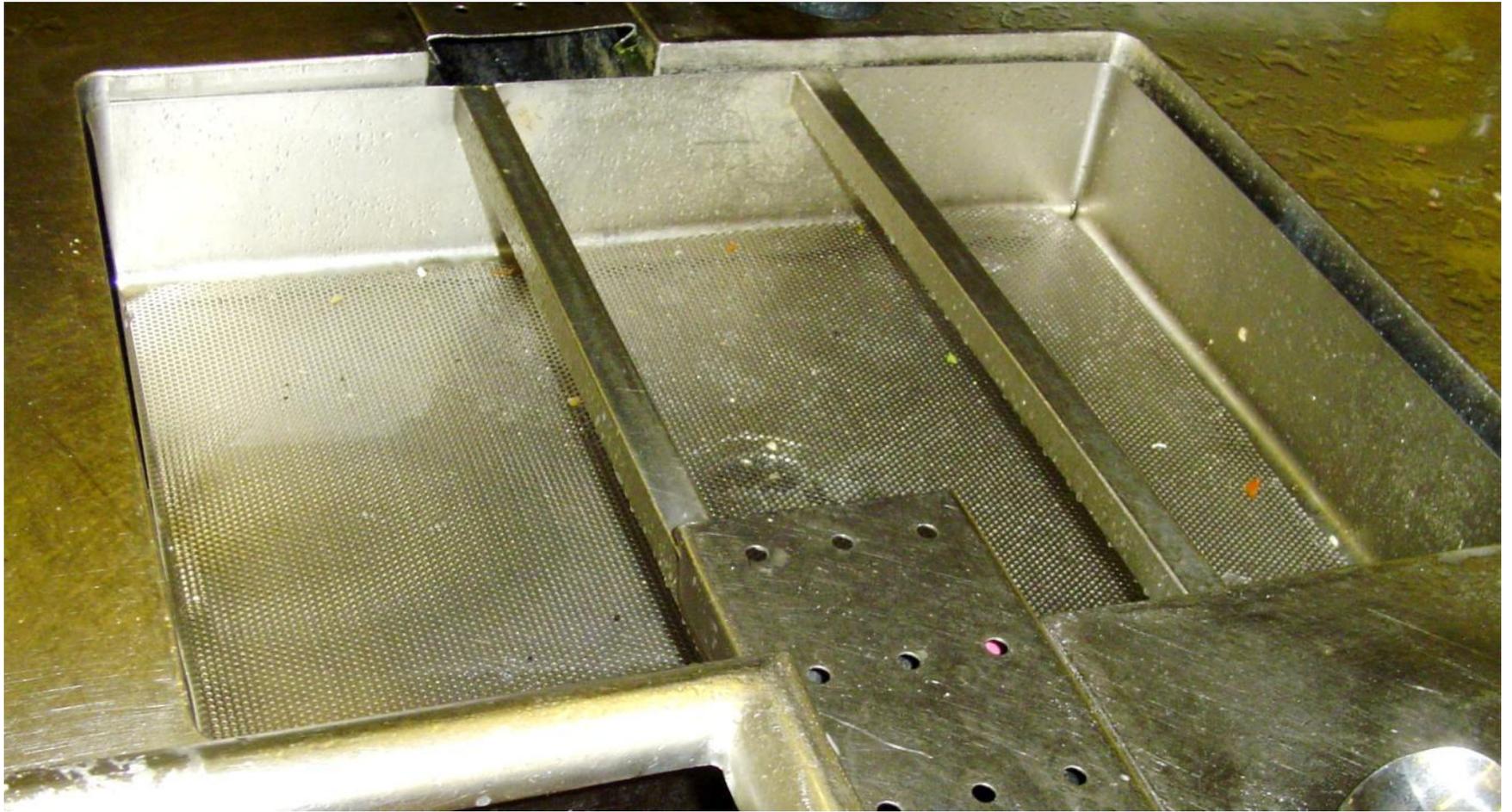


Old System



Scrap Basket

A Retrofit Strainer Basket in a Sink



Trough and Spray in Use



- **The trough plus the spray valve can use over 15 gallons a minute**

Summary of Five Waste Disposal Methods ^(a)

Parameter	Grinder	Mechanical Strainer	Pulper	Strainer Basket	Composting
Solids to Sewer	Yes	No	No	No	No
Recirculate	No	Yes	Yes	No	No
Strain Solids	No	Yes	Yes	Yes	N/A
Compost Produced?	Possibly At Wastewater Treatment Plant	Yes	Yes	Yes	Yes
Solid Waste Produced?	No	Yes	Yes	Yes	No
Flow Restrictor?	Yes	No	No	N/A	N/A
Horsepower	1-10	0.75-7.5	3-10	0	0 ^(b)
Potable Water Use (gpm) ^(c)	3-8	1-2	1-2	0	0
Sluice Trough (gpm)	2-15	2-15	2-15	0	N/A

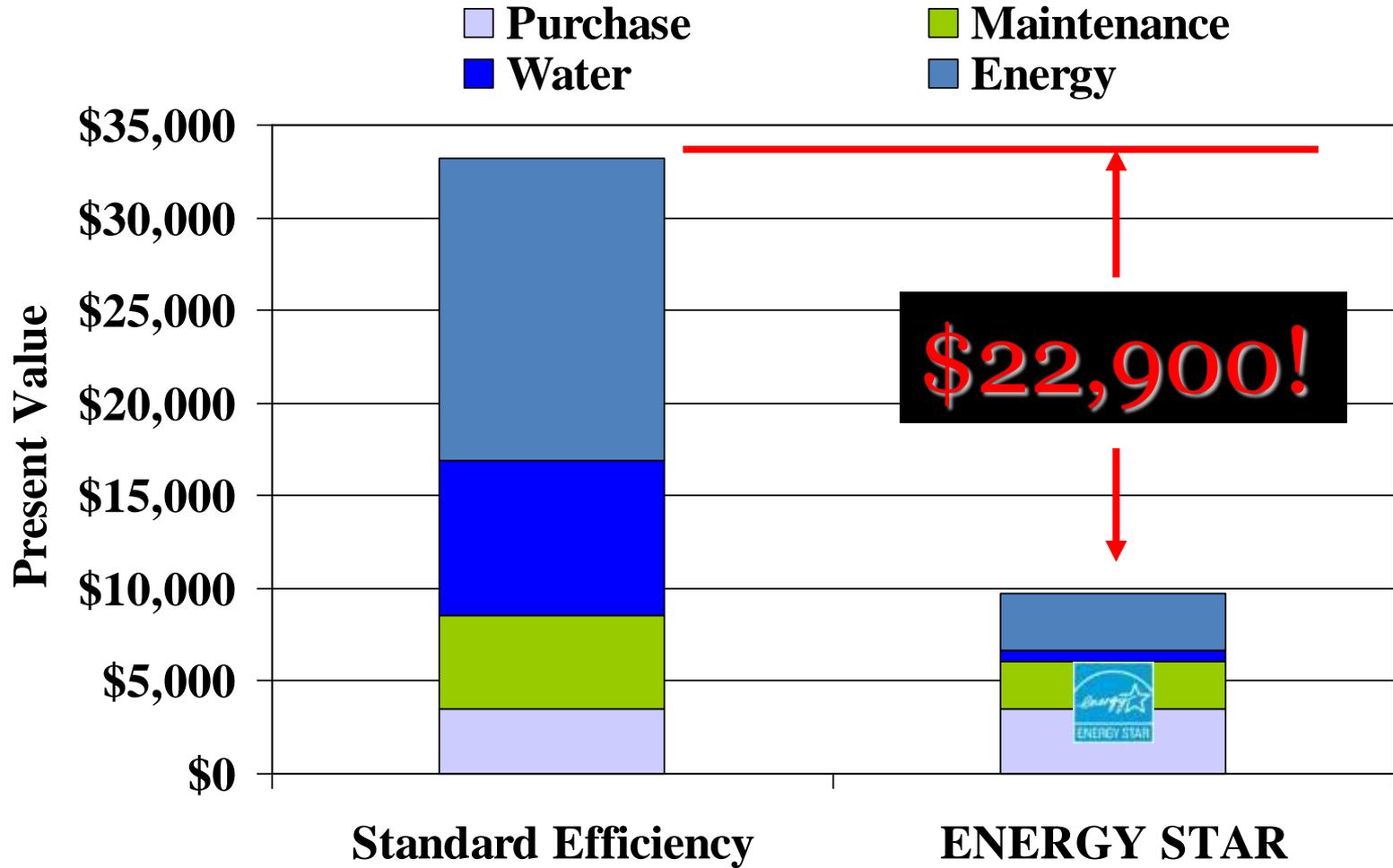
- a) Disposal of food waste as a solid waste to landfills by use of dumpsters is the other method of food waste disposal.
 b) Energy may be used to remove waste to off-site composting facility.
 c) Does not include water used by pre-rinse spray valve.

Boilerless Steamers



- **90% less water**
- **75% less energy**
- **No water hookup**
- **No sewer hookup**
- **No vent**

8 Year Life Cycle Cost Analysis



This one used 150 Gal./Hr.!!!



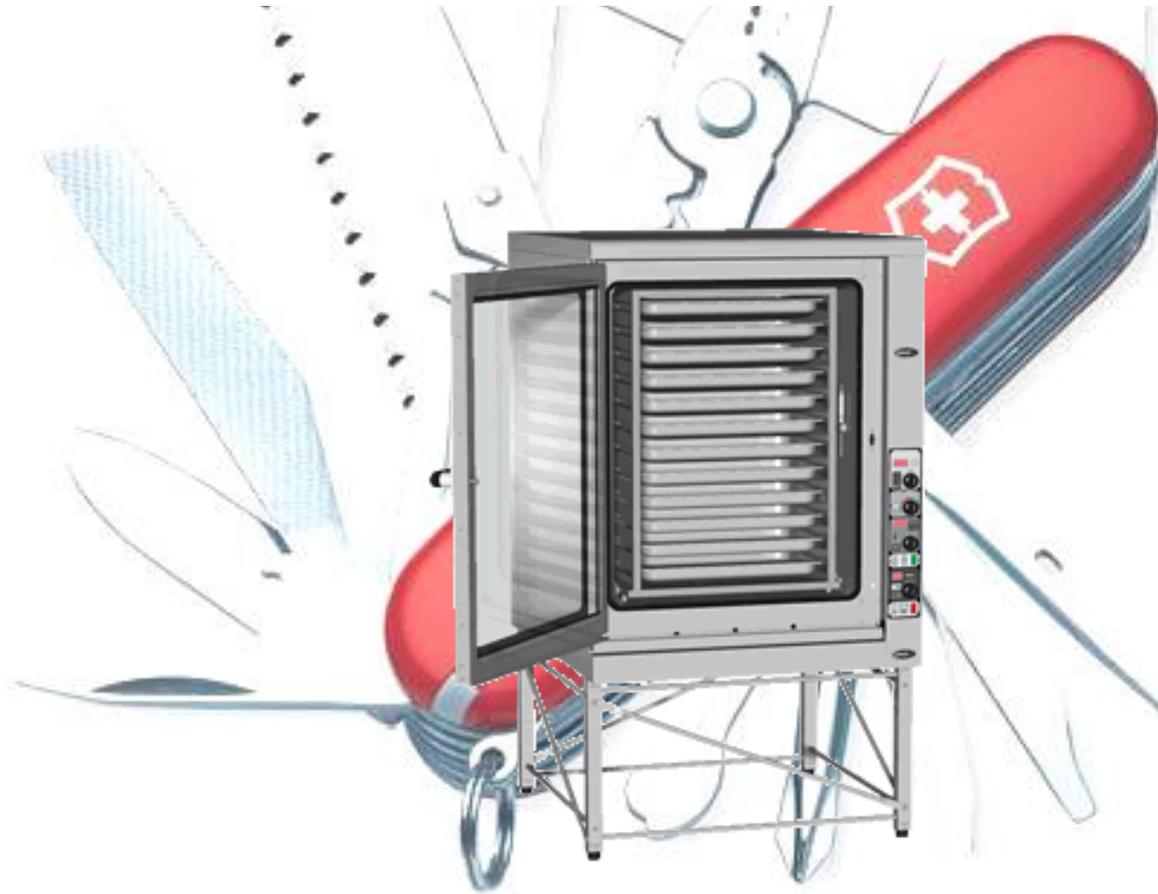
Combination Ovens



- **Boiler and atomizer types**
- **See PG&E rebate list**
- **Should use under 3.5 gallons a hour.**

Combination Ovens

The Swiss Army Knife of Cooking Appliances!



**Convection
Oven**

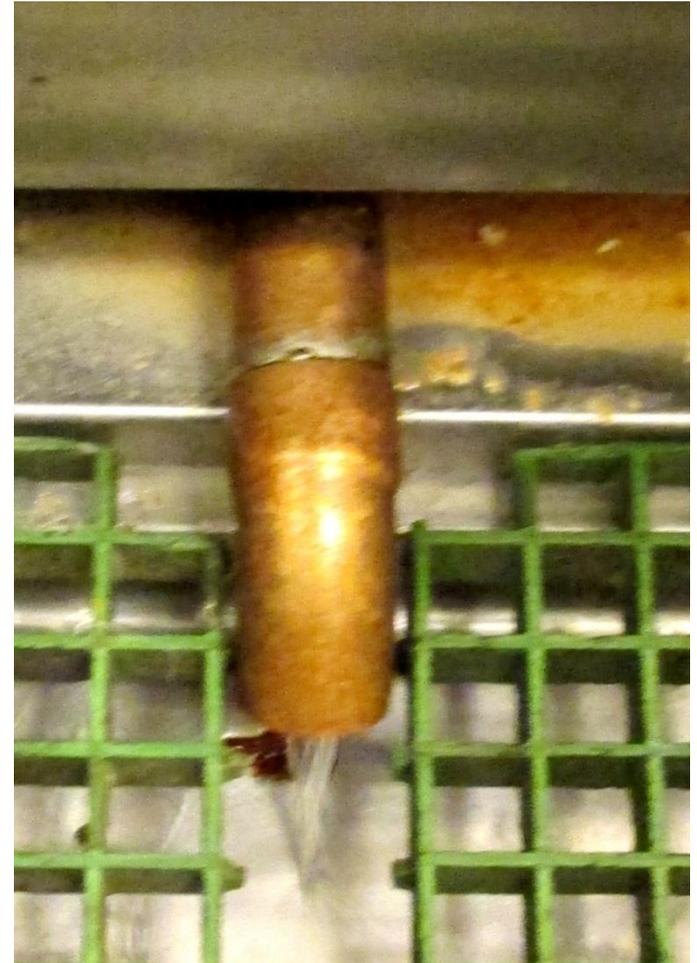
Steamer

**“Combi” Mode
Oven**



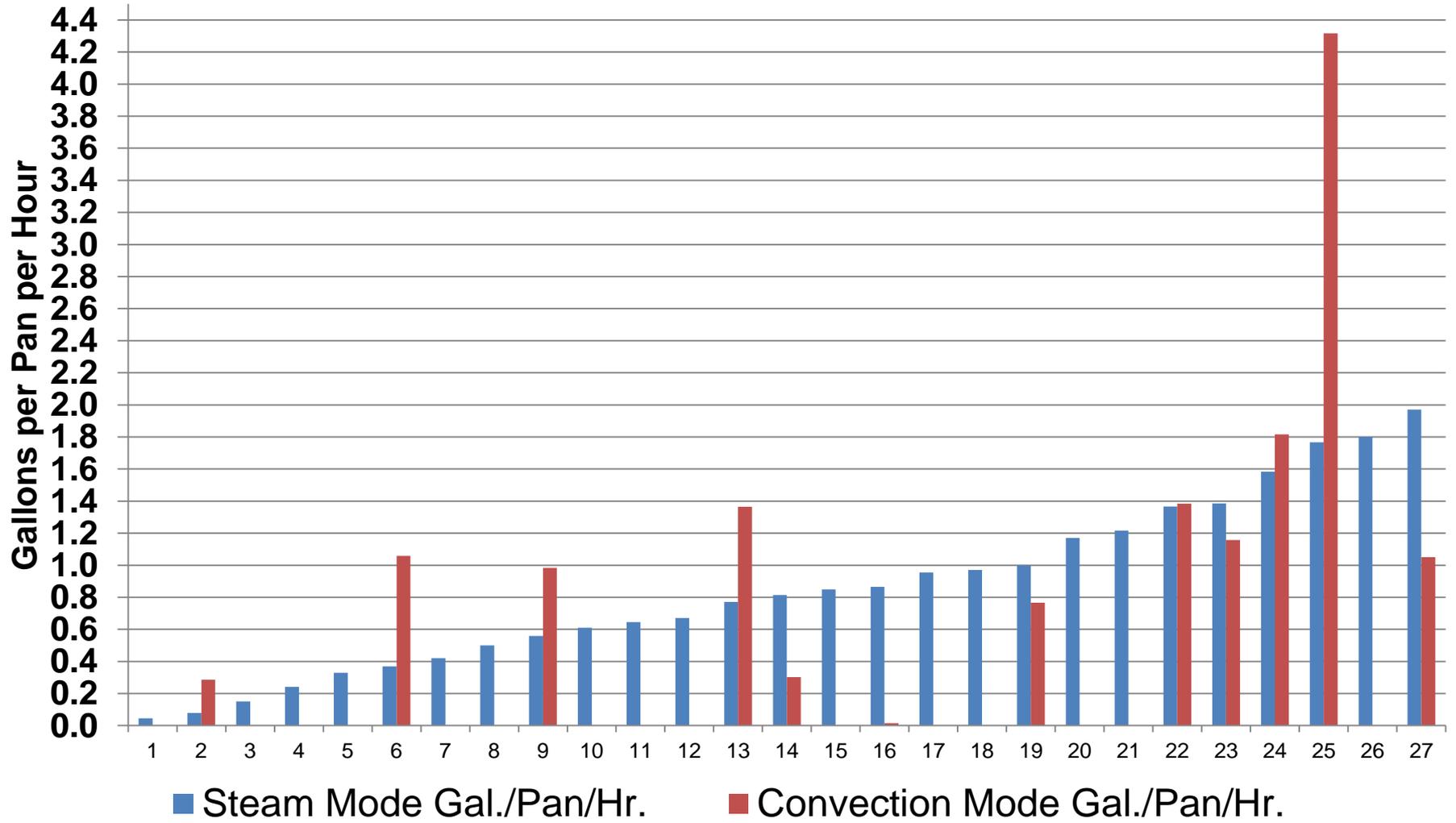
**Boiler Based Steamer and Combi Oven
Average Water Usage = 40 gph**

This old Combi Oven Uses 90 Gallons an Hour



Summary of **Combination Oven** Water Use Rates from Food Service Technology Center Energy Rebate Information July 2013

27 models ranging from 6 to 40 pans

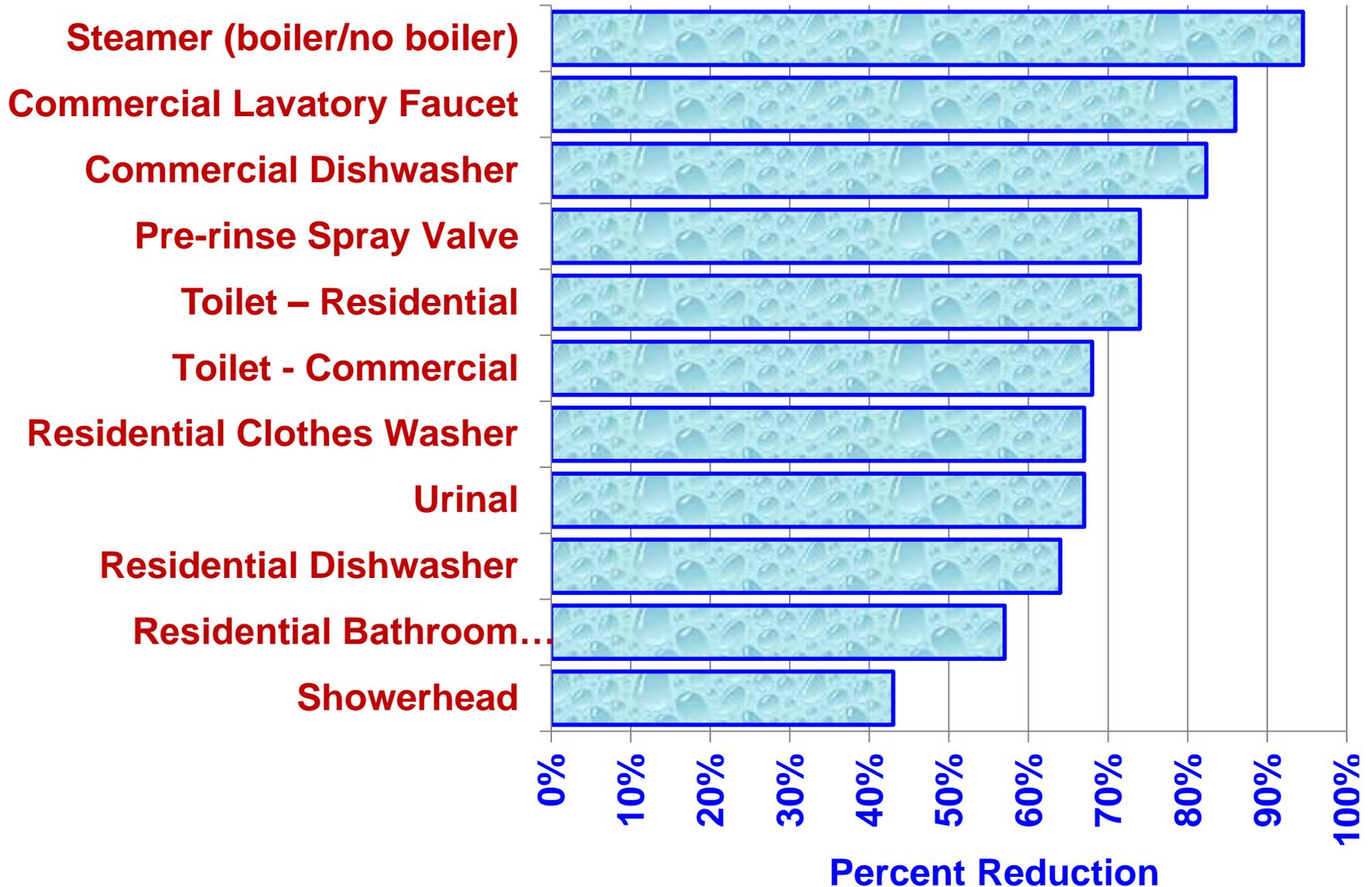


Saving Water

The Seven *“First Questions”*

1. Where is it being used?
2. When is it being used?
3. How is it being used?
4. Who is using it?
5. Why is the water use necessary?
6. Can the amount of water being used be reduced by simple change in procedure?
7. Is there a way to accomplish the same thing without using water?

Reduction in Water Use since 1980



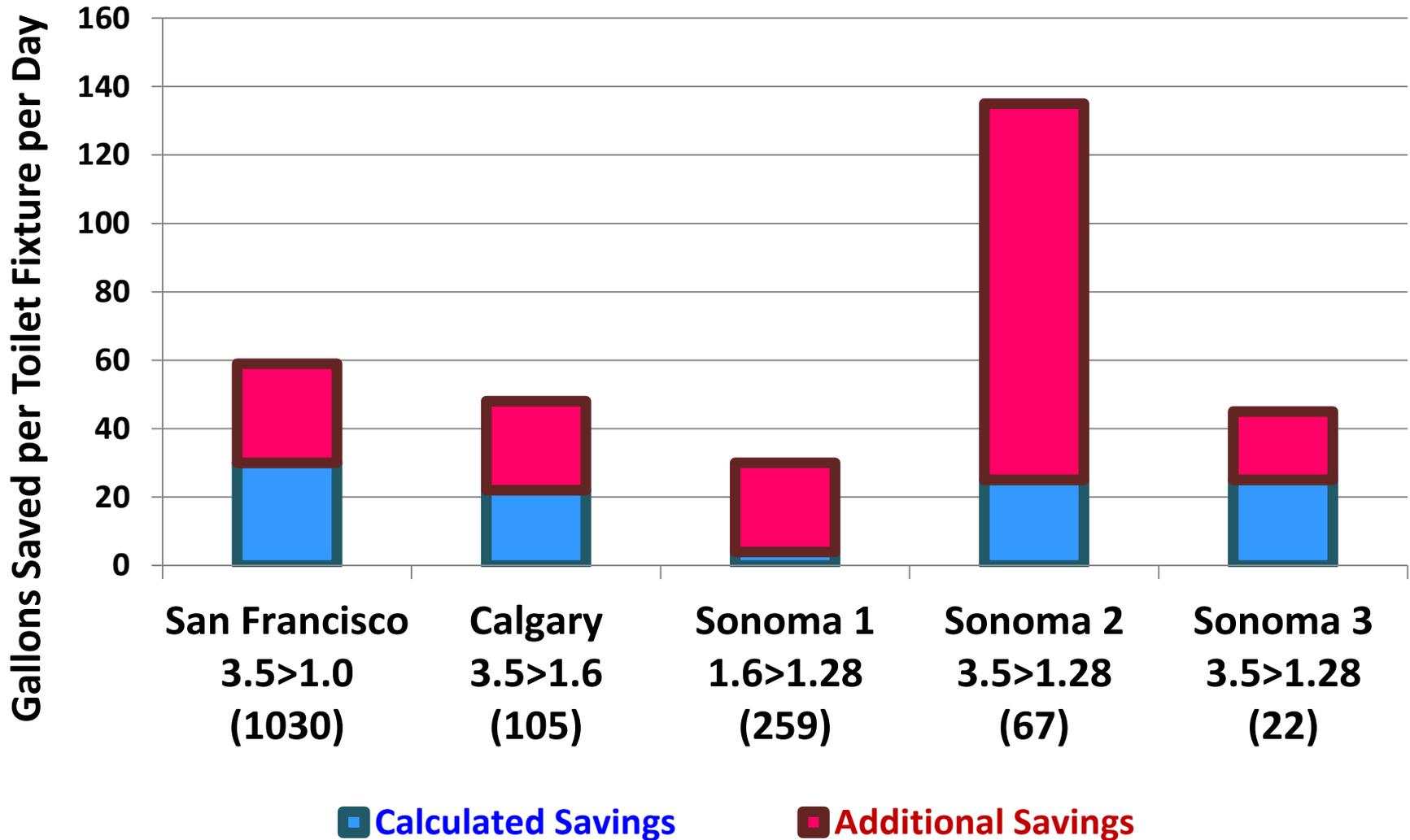
Study of Fixture Replacements in Five Hotels

Source: Koeller and Company

Hotel	Number of Replacements	Rated Flush Volume		Type of Replacement Toilet
		Before	After	
San Francisco	1030	3.5	1.0	Pressure Assist
Calgary	105	3.5	1.6	Gravity Fed
Sonoma 1	259	1.6	1.28	Gravity Fed
Sonoma 2	67	3.5	1.28	Gravity Fed
Sonoma 3	22	3.5	1.28	Gravity Fed

Water Savings - Hotel Guest Rooms

Source: Koeller and Company

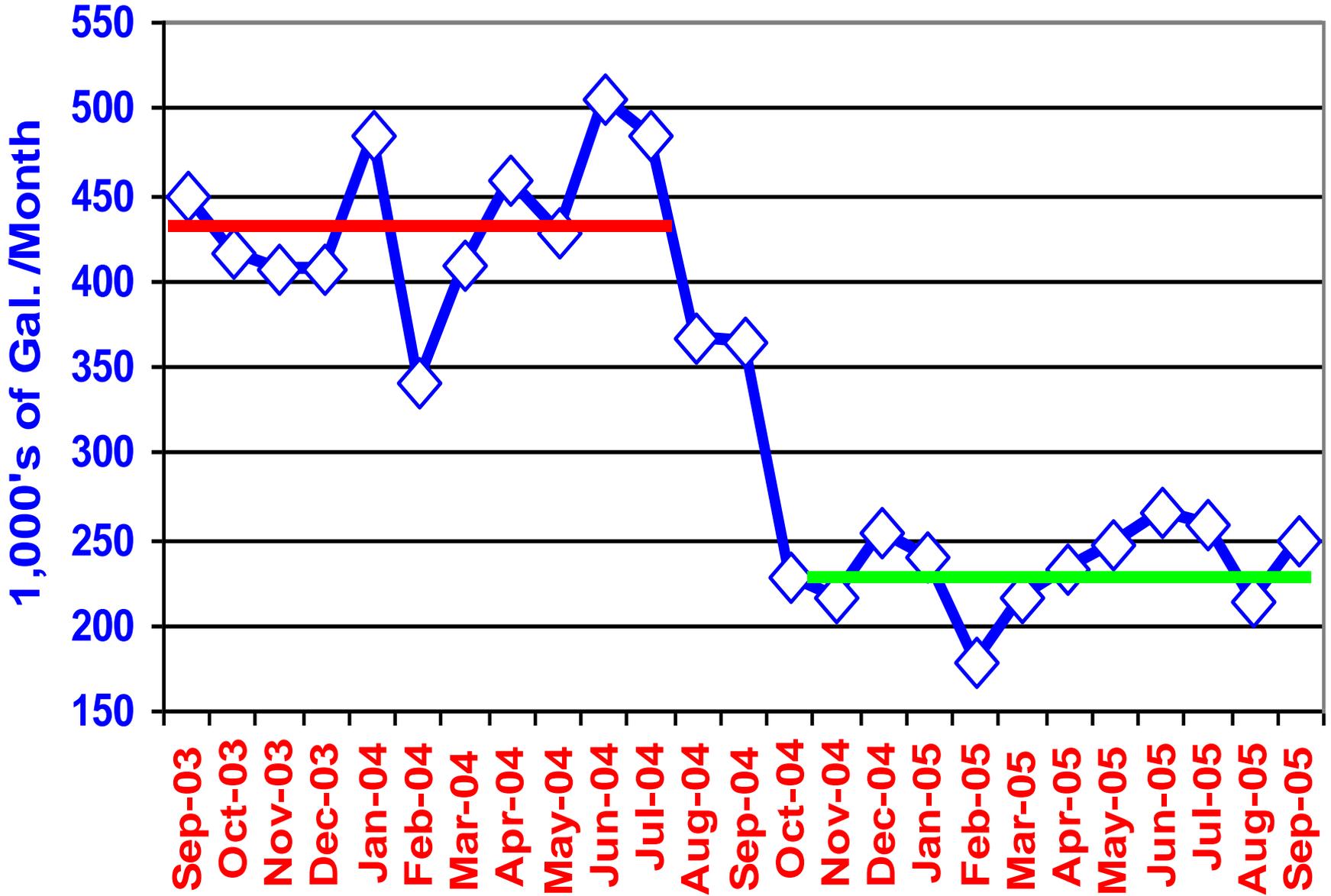


Additional savings include housekeeping, fixing leaks, new shower heads and faucet aerators

Measurement & Verification

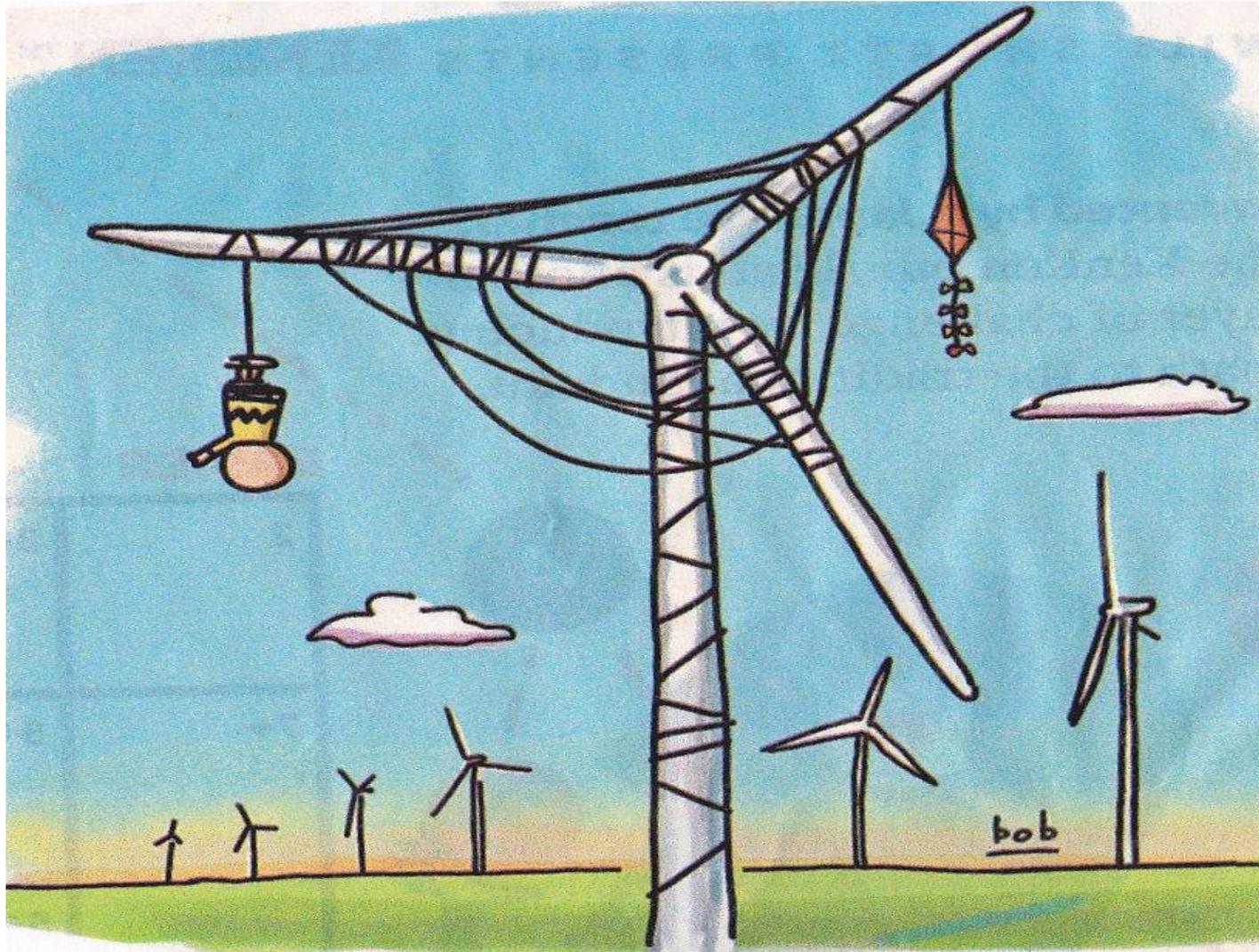
- Purpose – to ensure that savings are substantiated
- Measure *before and after*
- Individual equipment measurement
- Establishing the baseline and post use

A Large Chinese Buffet Restaurant



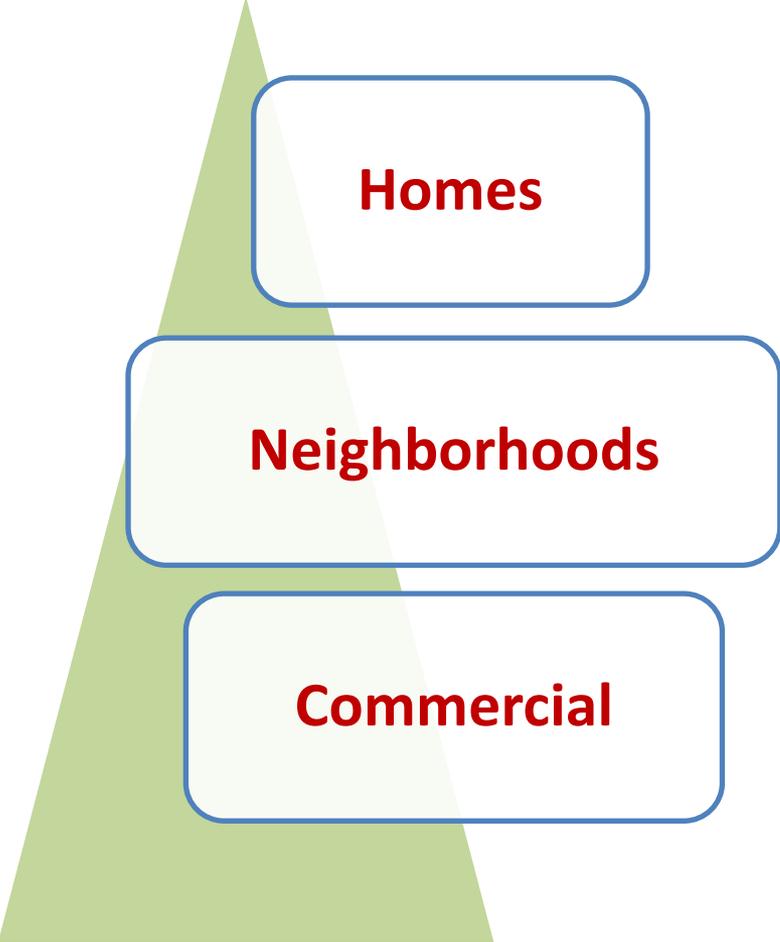
Going Green

Going Green is the “In Thing” According to Charlie Brown



US Green Building Council

2013 LEED Products



Homes

Neighborhoods

Commercial

2013 LEED Commercial

- New Construction
- Existing Buildings
- Core & Shell

❖ *Schools*

❖ *Hospitality*

❖ *Health Care*

❖ *Retail*

❖ *Data Centers*

❖ *Warehouses*

LEED Water

2013 - V4

- Metering
- Landscape
- Fixtures % fittings
- Cooling towers
- Medical equipment
- Food Service Equipment
- Laundry & Other Equipment
- Wastewater

New LEED Version 4 Rating System for Hospitality

LEED CREDIT AREA	Maximum Points	
	New Construction	Existing Buildings
Integrative Processes	1	n/a
Location & Transportation	16	15
Sustainable Sites	10	10
Water Efficiency	11	12
Energy & Atmosphere	33	38
Materials & Resources	13	8
Indoor Environmental Quality	16	17
Innovation	6	6
Regional Priority	4	4
TOTAL	110	110

Rating System	Certified 40-49 points	Silver 50-59 points	Gold 60-69 points	Platinum 80+ points
----------------------	----------------------------------	-------------------------------	-----------------------------	-------------------------------

New 3013 LEED for Food Service Equipment

Food Service Equipment	Baseline	Prescriptive
Combination Ovens	4.0 gal/pan/hr	1.5 gal/pan/hr
Food Steamers (batch or boilerless)	30 gal/compartments/hour	<10 gal/compartments/hour
Food Steamers (boiler type)	40 gal/compartments/hour	<15 gal/compartments/hour
Ice Machines	Once through water cooled banned!	
Ice Machines - under the counter	<35 gal./100 lb/day	<30 gal./100 lb/day
Ice Machines - all other	<25 gal./100 lb/day	<20 gal./100 lb/day
door type dishmachine - high temp	1.44 gal/rack	≤ 0.95 gal/rack
door type dishmachine - low temp	1.85 gal/rack	≤ 1.18 gal/rack
multi-tank rack conveyor dishmachine - high temp	1.1 gal/rack	≤ 0.54 gal/rack
multi-tank rack conveyor dishmachine - low temp	0.99 gal/rack	≤ 0.54 gal/rack
single tank rack conveyor dishmachine - high temp	1.13 gal/rack	≤ 0.7 gal/rack
single tank rack conveyor dishmachine - low temp	1.23 gal/rack	≤ 0.79 gal/rack
undercounter dish machines - high temp	1.98 gal/rack	≤ 1 gal/rack
undercounter dish machines - low temp	1.95 gal/rack	≤ 1.7 gal/rack

New Proposed LEED NC Just for Process Equipment

	EQUIPMENT	DESCRIPTION	METRIC	CREDIT
COMMERCIAL KITCHEN	DISH WASHERS	Under counter, stationary single tank door, single tank conveyor	Less than or equal to 1 Gallon/Rack	1
		Under counter, stationary single tank door, single tank conveyor	Less than or equal to 0.7 Gallon/Rack	2
		Flight Machines	Less than 1 gal/100 9" Dishes	1
		Flight Machines	Less than 1 gal/120 9" Dishes	2
	FOOD STEAMERS	Connection less	US EPA Energy Star label	0.5
	COMBINATION OVENS	Connection less	US EPA Energy Star label	0.5
LAUNDRY	CLOTHES WASHERS	On Premise Laundry Minimum Capacity 2400lbs/8hr shift	Less than or equal to 2.25 Gallons per pound	0.5
		On Premise Laundry Minimum Capacity 2400lbs/8hr shift	Less than or equal to 1.8 Gallons per pound	1
		On Premise Laundry Minimum Capacity 2,400lbs/8hr shift	Less than or equal to 1.0 Gallons per pound	2

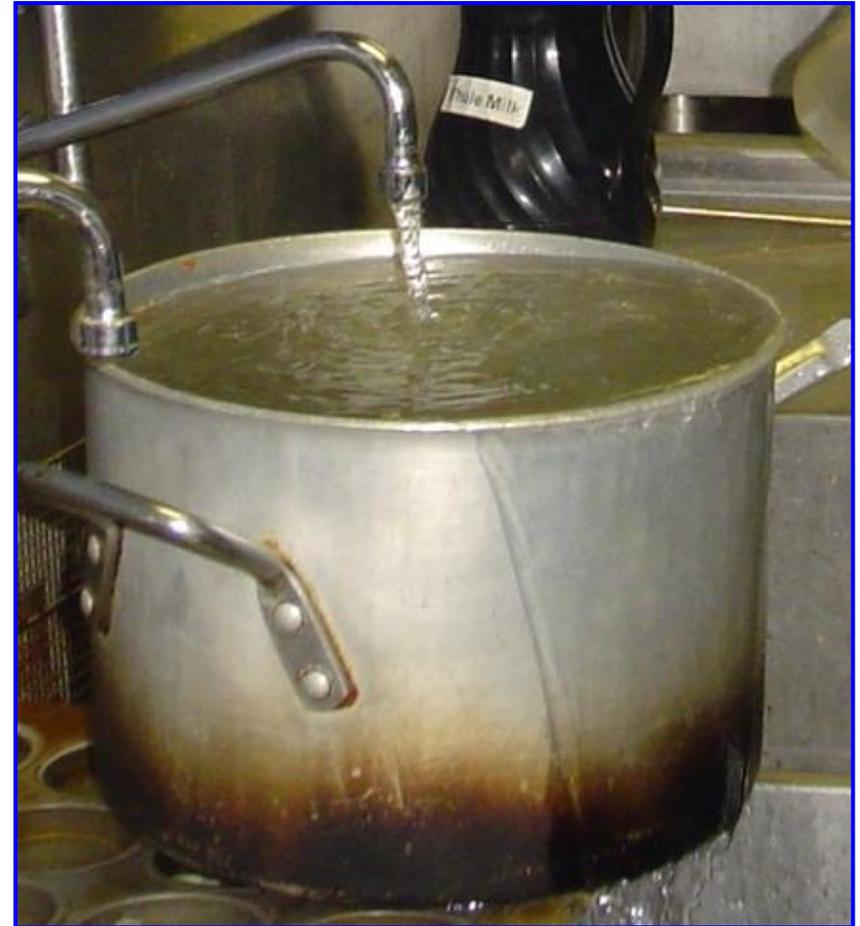
There are better ways



Control Defrost Water



There are better ways cont.

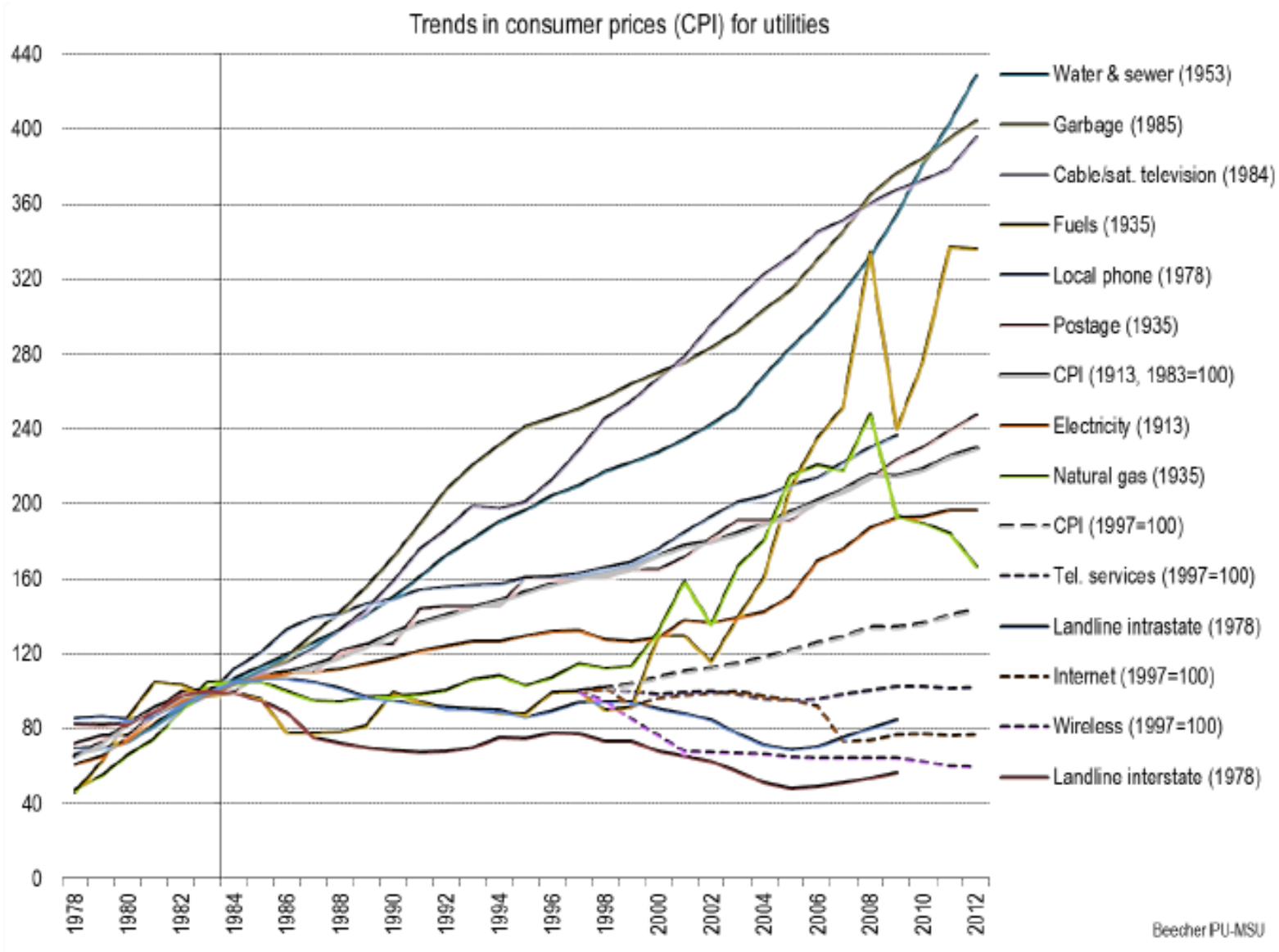


Leaks Add Up Fast!



**“Water is the oil of
the 21st century.”**

*Andrew Liveris,
Chief Executive,
Dow Chemical Co.,
August 2008.*



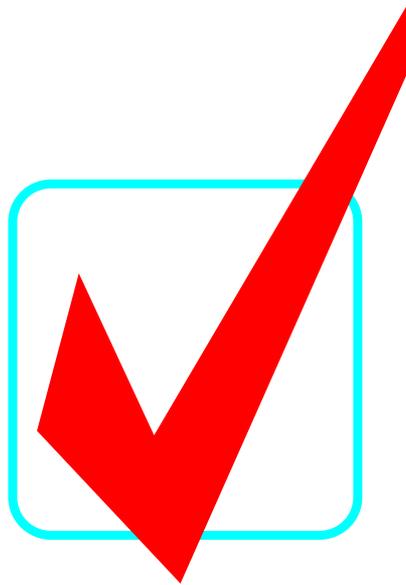
Beecher PU-MSU

Exhibit 3. Trends in the Consumer Price Index for utilities (detailed, 1978-2012).

The index is set to 100 for 1982-1984 except for telephone, wireless, and internet services, where the index is set to 100 for 1997. Year () indicates start of series.

**The Cheapest Water
You Will Ever Have
Is The Water You
Already Have!**

The



End



www.watermgt.com

(703) 370-9070

GSA Contract # GS-21F-0038T