

The Water-Energy Nexus

Applications in the Hospitality Sector

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The Water – Energy Nexus

Background

- Water Use Balance
- Benchmarks
- Costs and Trends

Energy – Water Connection

- Water Use Cycle - Big Picture
- Energy Impact

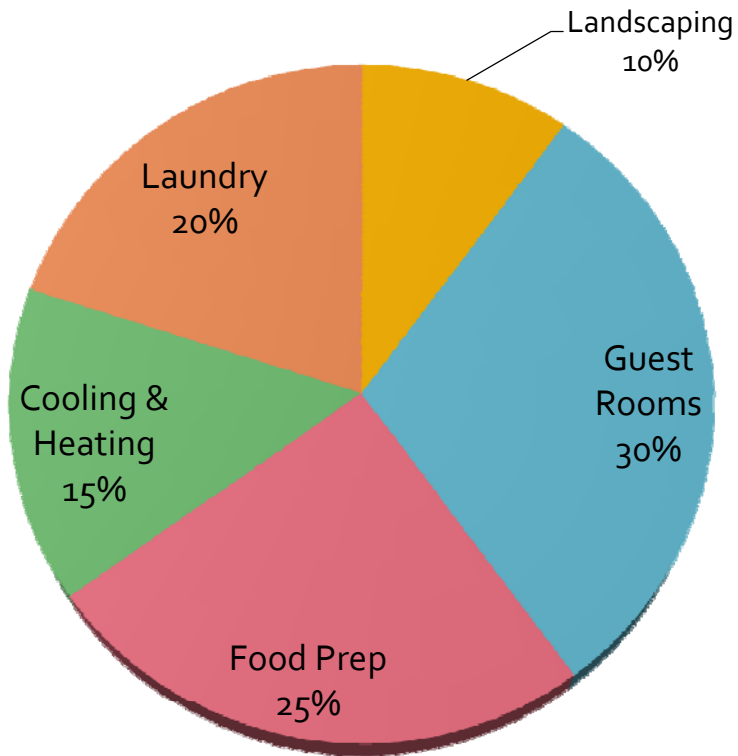
Determine your water-energy savings potential

- Calculating Energy in your Project's Cost Benefit Analysis
- Example applications (and economics)
- Future and resources

Water and Energy Balances

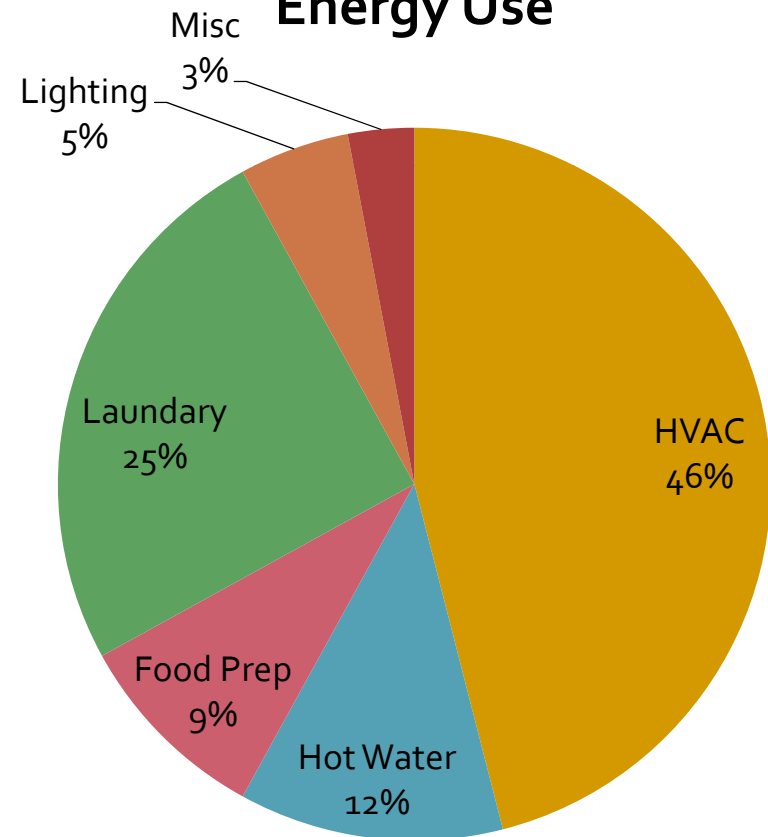
Hotel and Motel Examples

Water Use



Source: NCDENR, 2008

Energy Use



Source: Waste Reduction Partners, 2006

Benchmarks - Use

- Water Use

- 79-165 gallons/square foot (Benchmark Task Force, Colorado, 2007)
- 30,000-39,500 gallons per room (Benchmark Task Force, Colorado, 2007)

Suggested Index

- 60 - 173 gallons per guest (Waste Reduction Partners, 2002-06)
- 95 - 125 gallons per guest (La Quinta Inns & Suites, 2002)

- Energy Use

- 70.6 KBtu/square foot (EPA Energy Star 2007)

Benchmarks - Costs

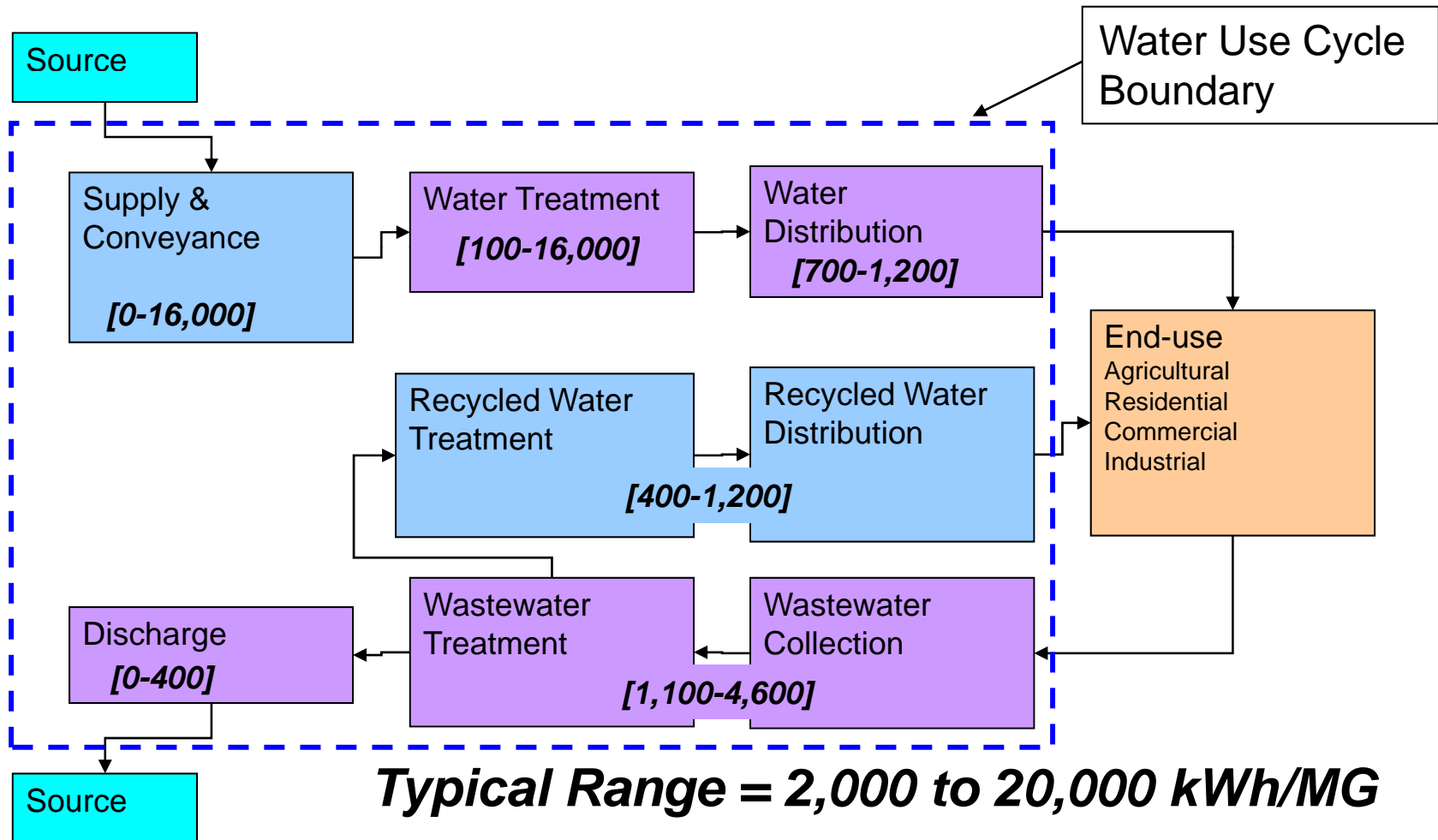
Water & Sewer Cost

- 79-165 gallons/square foot (Benchmark Task Force, Colorado, 2007)
- \$0.53 – \$1.11 / square foot (based on \$6.75 /1,000 gallons)

Energy Use

- 70.6 KBtu/square foot (EPA Energy Star 2007)
- \$1.65/square foot (based on \$0.08/kWh)

Water Use Cycle Energy Intensities (kWh/MG)



Source: California Energy Commission, 2005 Integrated Energy Policy Report

Energy Impacts

Water & Sewer Utility Sector Costs – Energy

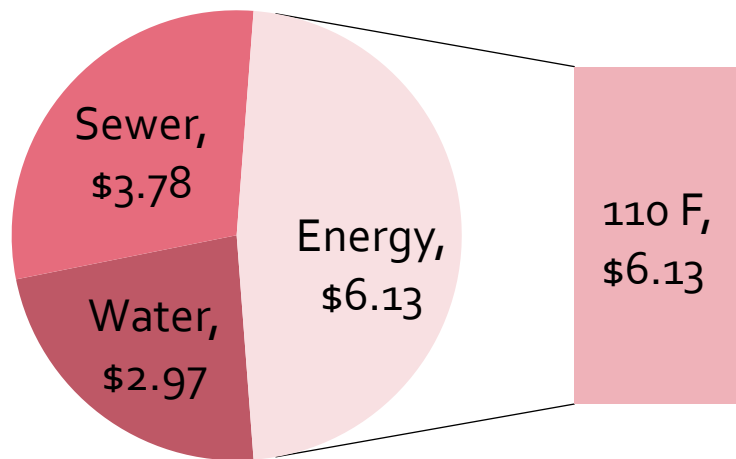
- .006 - .06 MMbtu/1000 gallons
- 2-20 kWh/1000 gallons
- \$0.16-\$1.60/1000 gallons

Water - Energy Use – Hospitality Users

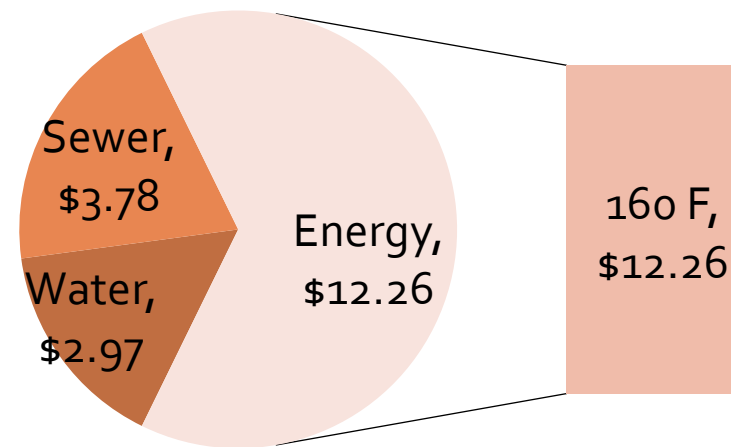
- Hot Water cost 12% - 40% of total energy use
- \$0.20 - \$0.66/square foot (based on \$0.08/kWh)

Cost of Hot Water

Cost per 1000 Gallons



110 Degree F Water



160 Degree F Water

A sample calculation

Principle – Takes 1 Btu to raise one pound of water one degree F

- \$1.25 per Therm (i.e. 100,000 Btu)
- 50 ° F - ΔT Temperature rise
- 1 gallon water weighs 8.34 pounds
- Heating Efficiency - 85% for natural gas

$[(50 \text{ }^\circ\text{F} \times 1000 \text{ gallon} \times 8.34 \text{ lb/gallon}) / 100,000 \text{ Btu/therm}] \times$
 $\$1.15/\text{therm} / .85 \text{ efficiency factor} = \$6.13/1000 \text{ gallons}$

Application Example

	Existing	Upgrade	Unit	% Improvement	Annual Water Saving	Basis	Water/Sewer Cost Savings	Energy Cost Saving	Total Utility Savings	120 Room Hotel	Payback w/o energy	Payback with Energy
Lavatory Faucets	2.2	1.0	gpm	55%	846	per room	\$5.71	\$5.18	\$10.89	\$1,307	0.9	0.5
Shower-heads	2.2	1.5	gpm	32%	2,989	per room	\$20.18	\$18.32	\$38.50	\$4,620	1.0	0.5
Pre-rinse Sprayer	2.5	1.6	gpm	36%	39,420	per location	\$266.09	\$241.64	\$507.73	\$1,015	0.4	0.2
Dish-washers	1.8	1.0	gpr	44%	584	per room*	\$3.94	\$7.16	\$11.10	\$1,332		
Laundry	9.5	6.0	WF	37%	282,395	per site	\$1,906.16	\$3,462	\$5,368.32	\$5,368		

Water – Energy Summary

- Hot water equates to 12 -40% of total energy use
- Cost to supply hot water can to 2 to 3 times the cost of water/sewer
- By including energy cost savings in water project analysis, can cut payback period in half