



# Controlling Costs:

## Energy Management of Water Systems

Glenn Barnes

Environmental Finance Center

University of North Carolina at Chapel Hill

919-962-2789

[glennbarnes@sog.unc.edu](mailto:glennbarnes@sog.unc.edu)



# Session Objectives

- Identify ways to improve the energy performance of your water system.
- Look at examples of similar entities doing energy management around the country.
- Hear about what you are doing or are considering doing at your small water system.



# Energy Management Approach

1. Improve the energy efficiency of your small water system
2. Use less water (water efficiency)
3. Reuse water
4. Generate renewable electricity on-site



# Improve Energy Efficiency

- Use less electricity to achieve the same level of performance
- Employ efficient pumps and motors



# Water Utility Equipment Changes

- Madera Valley, CA
  - Serves 1,600 customers

Energy Efficiency Improvement	Annual Baseline Energy Cost	Annual Post-Implementation Energy Cost	Annual Estimated Savings
Install variable-frequency drives and programmable logic controls at wells 1 and 10	\$68,000	\$51,000	\$17,000
Install energy-efficiency motor instead of standard motor in new well (no. 10)	\$40,000	\$39,000	\$1,000
Replace standard efficiency motor with energy efficient motors (wells 1, 2, and 3)	\$76,000	\$75,000	\$1,000
<b>Estimated Total Annual Savings</b>			<b>\$19,000</b>



# Water Utility Equipment Changes

- Valparaiso, IN

The Valparaiso Water Department has reduced electrical energy use by implementing numerous strategies.

Process Targeted / Goal	Improvement and estimated saving	Estimated annual energy saving, kWh	Implementation cost, \$	Annual cost saving,	Simple pay-back, years
Lighting	Reduced number of lighting hrs by 40%	7488	No cost. Turn lights off	\$749	0
Lighting	Will replace T12 with T8 bulbs and fixtures	1,098		\$110	No estimate
High service pumps	Replacing high service pumps with premium efficiency ones at both plants	34,640	\$52,400	\$3,464	15.1
HVAC <sup>1</sup>	Purchased portable HI-E dehumidifiers to replace the gas burning dehumidifier.	36,000	\$500	\$13,600	1



# Villa Magna Condos, FL

- Replaced fixed speed pump motors with variable speed drives and motors
- Installed solar panels, heat pumps, energy efficient lighting and appliances
- Pumping system is now more reliable
- Significant savings on electricity and water



# Villa Magna condos: Results

- Saving about \$2,000 per month on their water bill.
- And have saved \$24,000 on electricity across the past year.



# Improve Energy Efficiency

- Has anyone in the room done this? Are you considering it?



# Use Less Water

- You can manage energy costs by managing water use. The less water you use, the less energy you use.
- For example, pumping water around your facility costs you electricity



# Use Less Water

- If you charge for water based on usage, you should be concerned about water efficiency at least until the meter
  - Depending on your water supply vs. water demand, you may also be concerned about water use by your customers



# Use Less Water

- If you do not charge for water based on usage, you need to be concerned about water efficiency all the way through the point that your customers consume the water



# System Leak Detection & Repair

- How much water do you treat? How much do you sell?
- How much of that difference is “non-revenue” water? How much is just lost through the pipes?

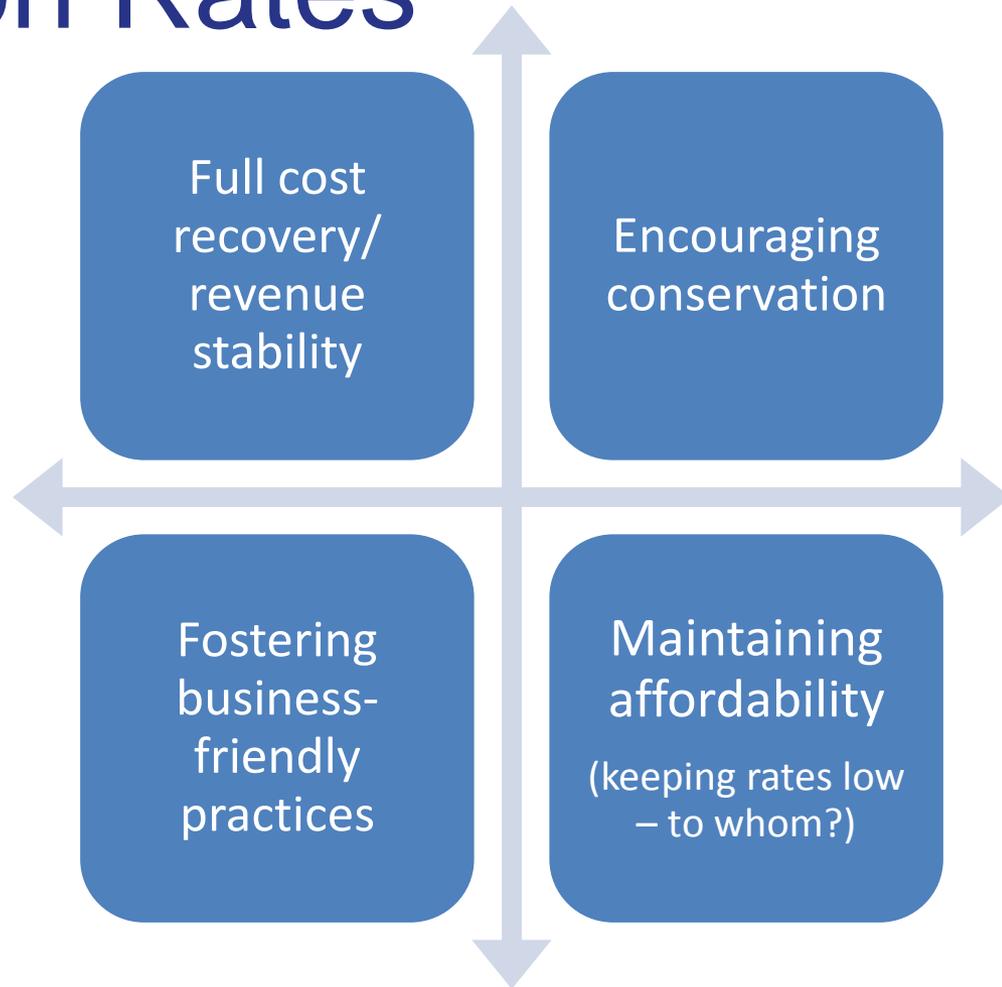


# Gallitzin, PA

- Serves about 1,000 connections
- In 1990s, had 70 percent water loss
- Intensive water loss detection and repair program dropped percentage to 9 percent in 4 years
- Reduced electricity bill by 61 percent and chemicals bill by 47 percent



# Conservation Rates





# Help Customers Use Less

- Really important for systems where demand for water is nearing supply and storage capacity or if you do not charge customers based on their usage
- Key for systems with growing populations



# Ashland, OR

- Serves about 20,000 customers
- Offered water audits for customers and a high-efficiency showerhead and toilet program, plus rebates for efficient washers
- Prevented need for multi-million dollar dam or pipe extension project



# Gilbert, AZ

- Population increased from 5,000 to 100,000 in 20 years, with about 7 inches of annual rainfall
- Building codes for new construction include requirements for efficient plumbing and for water reuse



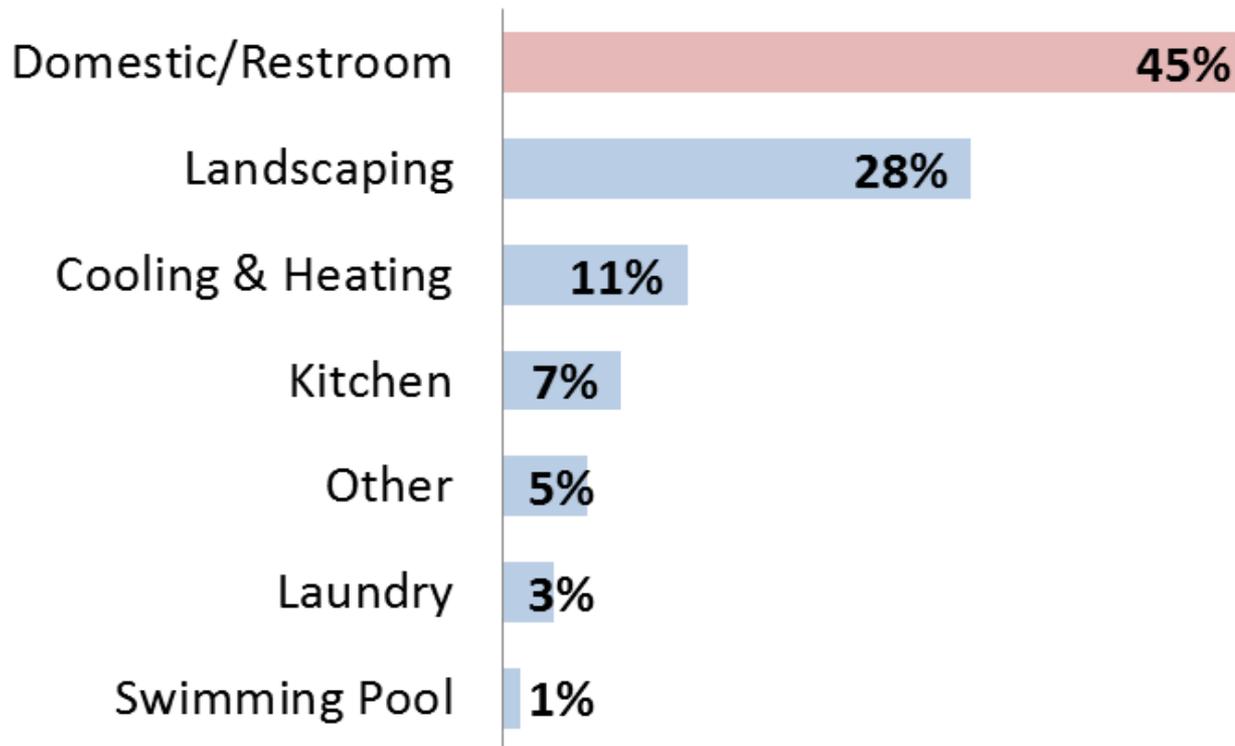
# Santa Monica, CA

- The Water Efficiency Revolving Loan Program provides no-interest loans to institutional, commercial, and residential water customers to pay for plumbing fixture retrofits, irrigation system upgrades, and other cost-effective water efficiency measures.



# Typical Water Use of a School

## Restrooms are Biggest Users





# Seffner, FL High School

- Could save 4+ million gallons of water/year, 22% of its annual water use
  - Low-flush toilets: 790 kgal and \$6,100
  - Cooling adjustments: 60 kgal and \$150
  - Irrigation changes: 3,100 kgal and \$7,600

<http://www.swfwmd.state.fl.us/conservation/waterwork/>



# Cobb County Schools, GA

- Low-flow sink aerators replacing high-flow aerators or no aerators had a payback period of *days*
- Toilets, low-flow and waterless urinals, kitchen spray system changes
- Had deferred replacement
  - Was using a garden hose in place of a pre-rinse spray nozzle



# Use Less Water

- Has anyone in the room done this? Are you considering it?



# Water Reuse

- Find ways to re-use water for non-potable purposes
- Includes using non-potable water that has never been treated, such as collected rainwater



# Water Reuse

- Has anyone in the room done this? Are you considering it?



# Renewable Electricity Generation

- Produce your own power on-site to offset the power you buy from the utility
- Ability to lock in lower rates over time with PPA



# Renewable Electricity Generation

- Solar photovoltaic panels
- Small-scale wind power
- Landfill gas projects?
- Geothermal power?



# Energy Generation

- Keene, NH
  - Serves 5,100 customers
  - Water supply is at a higher elevation than the treatment plant, resulting in head pressure
  - Harnesses excess pressure through a turbine to generate more electricity than is needed to run the entire plant each year
  - Cost savings \$18,500 annually

# Comprehensive Approach

	Anticipated Expenditures for Energy Upgrades	Expected Annual Energy Savings*	Energy Efficiency Savings**	Total kW Savings	Est. CO <sup>2</sup> Reductions (tons)	Green Power Generation (kW)
Ashland Howe Street Water Treatment	\$486,353	\$75,428 (62%)	\$67,328 (55%)	194,464	229	Up to 45 kW (solar)
Easton Water Division	\$350,000.00	\$9,000 (6%)	\$0	60,000	46	Up to 50 kW (solar)
Falmouth Long Pond Water Treatment	\$228,062 <sup>†</sup>	\$52,352 (36%)	\$49,652 (34%)	278,200	213	Up to 15 kW (solar)
Lee Water Treatment	\$801,000	\$34,177 (106%)	\$7,926 (25%)	200,940	153	Up to 105 kW (solar & hydroelectric)
New Bedford—Quittacus Water Treatment	\$2,590,000	\$49,840 (9%)	\$25,000 (4%)	165,000 / 1,783 MMBTU	165	Up to 138 kW (solar)
Townsend Water Treatment	\$325,000	\$13,658 (40%)	\$5,000 (15%)	73,844	56	Up to 40 kW (solar)
Worcester Water Treatment	\$1,434,000	\$75,724 (25%)	\$28,492 (9%)	553,152	423	Up to 160 kW (solar & hydroelectric)
<b>Totals</b>	<b>\$6,091,353</b>	<b>\$310,179</b>	<b>\$183,398 (59%)</b>	<b>1,525,600</b>	<b>1,285</b>	<b>553</b>



# Renewable Electricity Generation

- Has anyone in the room done this? Are you considering it?