



Smart Management for
Small Water Systems

Managing Energy at Your Small Drinking Water System – A Workshop Series for North Carolina Utilities

Workshop 1 – Tuesday, 11/29/16

Land-of-Sky Regional Council,
Asheville, NC

Facilitators – Dawn Nall (SW EFC)
and Carol Rosenfeld (UNC EFC)

This program is made possible under a
cooperative agreement with EPA.



UNC
ENVIRONMENTAL
FINANCE CENTER



Southwest
Environmental
Finance
Center



Environmental
Finance
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Syracuse University

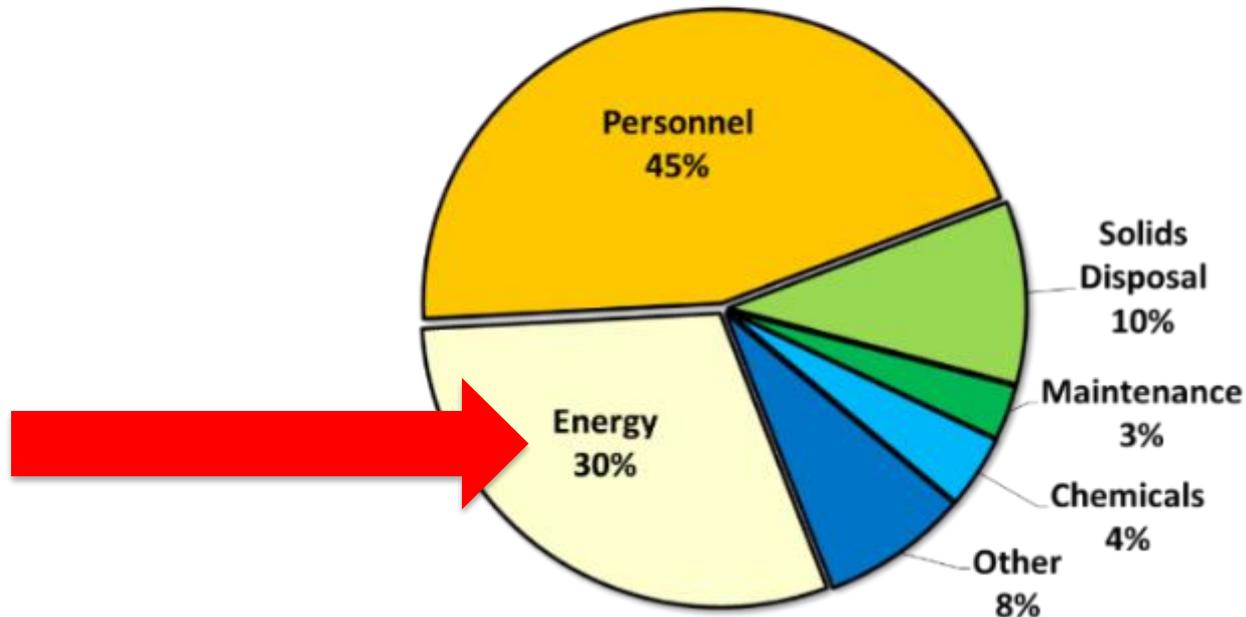


Why are we here?



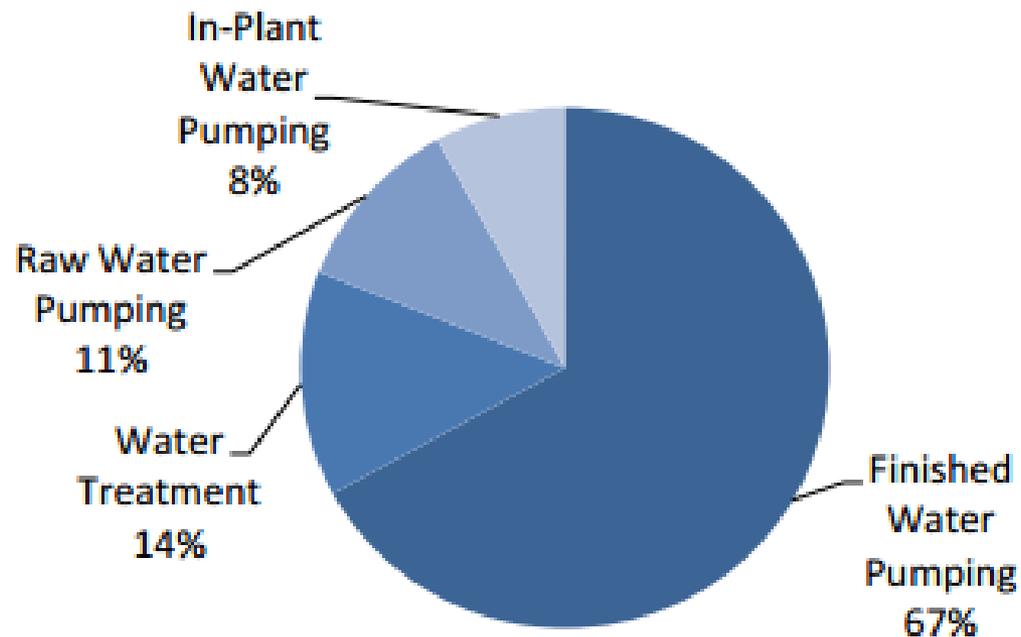


Typical Water Utility O&M Costs





Typical Energy End-Uses in Public Surface Water Systems



Source: Keith Carns, EPRI Solutions, "Bringing Energy Efficiency to the Water & Wastewater Industry: How Do We Get There?," presented at *WEFTEC 2005*, Washington DC, November 2, 2005.



Should a small water utility care about energy?



2 trillion
gallons of
H₂O:
estimated
amount
pumped each
year by small
systems.

\$1 billion:
estimated
electric power
costs per year
for these
small systems.

\$10 million:
annual
electric bill
savings from a
1% reduction
in electric
costs.

\$100 million:
annual
electric bill
savings from a
10% reduction
in electric
costs.

Source: Regnier and Winters, "Reducing electric power costs in small water systems," Journal AWWA, April 2013, 67-72.



Can your utility reduce energy costs?

PUMPS

- All pumps
 - Variable speed?
 - Premium efficiency motors?
- High Lift Pumps
 - Operate during off-peak hours?
 - Utilize in system storage to minimize peak hour pumping?

FLOCCULATION/COAGULATION

- Are mixers 2 speed or VFDs
- Do mixers have premium efficiency motors?

FILTRATION

- Backwash based on water quality or pressure?
- Do you have elevated backwash water storage tanks?
- Do pumps, blowers, compressors have premium efficiency motors?

NYSERDA Focus SMALL WATER TREATMENT PLANT CHECKLIST

<http://www.nyserdera.ny.gov/-/media/Files/EERP/Commercial/Sector/Municipalities/water-treatment-plant-check-list.pdf>



Can your utility reduce energy costs?

DISINFECTION

- UV System
 - utilize low-pressure, high-output lamps?
 - is system operated via flow-pacing and/or dosing setpoint?
- use ozone as a disinfectant?

RESIDUAL MANAGEMENT

- haul residuals to another location for processing?
- residuals currently used as part of a beneficial reuse program?
- utilize centrifuges for dewatering residuals?

OTHER

- energy improvement projects in last 5 years?
 - involved more efficient lighting?
 - involved load shedding and/or off-peak load shifting?
 - involved installation of new or improved HVAC equipment?
- capacity expansion and/or other upgrade projects in next 2 years?
 - are energy conservation measures included within the improvements?

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<http://www.nyserdera.ny.gov/-/media/Files/EERP/Commercial/Sector/Municipalities/water-treatment-plant-check-list.pdf>



Why does the EPA want you here?

- Energy usually represents the largest controllable cost of providing water to the public.
- Help water systems meet regulatory requirements to protect public health and the environment.



Energy Management Goals

- Improve energy efficiency & manage total energy consumption
- Control peak demand for energy
- Manage energy cost volatility
- Improve energy reliability
- *Other goals for your water system?*



Improve Efficiency & Manage Total Consumption

- Cost of electricity is typically based on two main components:
 - Quantity of electricity used (kWh)
 - Demand for electricity (kW or kVa)
- On-peak vs. off-peak consumption affects rates
- Understanding the electric utility's pricing policies (rate structures) is critically important



Control Peak Demand for Energy

- Electric utilities often include a “demand charge” in their rate structure
- Lower variability in electric demand over time (flattened demand curve)
 - Minimize changes in peak demand throughout the course of a billing period
 - Shifting loads from peak periods, typically during daylight hours, to off-peak periods
- Potential for significant cost savings by minimizing demand charges



Manage Energy Cost Volatility

- Energy costs fluctuate
- Dramatic changes stress budgets
- Protect against volatility as much as possible
 - Reducing need for energy
 - Long-term procurement of energy
 - Provisions for alternative energy sources
 - On-site generation of energy



Improve Energy Reliability

- Water utilities should be able to provide critical systems with adequate backup power
- Energy planning process should identify opportunities to improve energy reliability
 - Protection against complete loss
 - Identify changes in power quality that can damage equipment and/or
 - Institute operating procedures to address changes in overall power availability



Process:

Energy Management Workshop Series



Who: Dawn Nall, Southwest Environmental Finance Center

What: On-Site Water System Energy Assessment

Where: Your Water System



Energy Audit – Asset Inventory

Energy Use Inventory

ID Number	Asset Name	Type of Energy Used	Nameplate HP	Variable Speed Y/N	Measured Power Consumption (units)	Hours of Operation per Year	Total kWh per Year	Peak Energy Demand	Average Run Time	Operating Status	Design Specs.	Avg. Cost cents/kWh	Total Cost



Energy Management Workshop Series



Who: Dawn Nall, Southwest Environmental Finance Center, and Carol Rosenfeld, Environmental Finance Center at UNC School of Government

What: One Day Workshop Covering:

- Overview of Energy Management Planning
- Review of Energy Assessments
- Understanding Your Water System's Energy Bill

When: Tuesday, November 29, 2016

Where: Land-of-Sky Regional Council, Asheville, NC



Energy Management Workshop Series



Who: David Tucker and Carol Rosenfeld, Environmental Finance Center at UNC School of Government; Potential guest speakers on financing options or other topics

What: One Day Workshop Covering:

- Approaches to Project Prioritization
- Traditional Financing Mechanisms
- Special Financing Mechanisms

When: Wednesday, January 4, 2017

Where: Land-of-Sky Regional Council, Asheville, NC



Energy Management Workshop Series



Who: David Tucker and Carol Rosenfeld, Environmental Finance Center at UNC School of Government; Potential guest speakers on special topics

What: One Day Workshop Covering:

- Maintaining Momentum
- Communication Strategies
- Special Energy Topics (Renewables?)

When: Thursday, January 26, 2017

Where: Land-of-Sky Regional Council, Asheville, NC

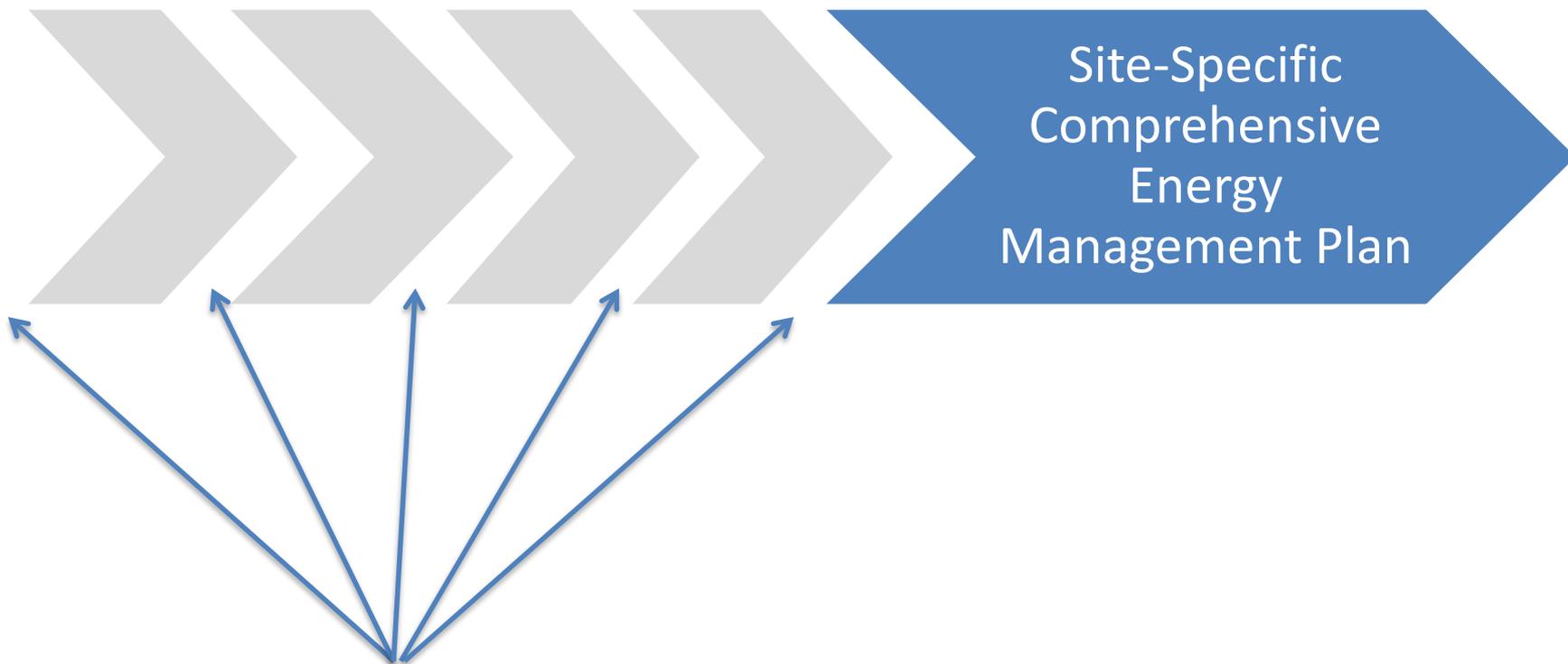


Energy Management Workshop Series





Energy Management Workshop Series



😊 Assignments between meetings 😊



High Impact Projects





- What are some of your highest impact energy projects?
- Or ones that you have considered doing for your water system?



Factors Affecting Energy Consumption in Public Drinking Water Systems

- Technical requirements
- Source of water
- Population served
- Water treatment
- Potable water storage
- Distribution system
- Source of electricity
- Plant building energy use
- Unaccounted-for-water
- Demand management

Lawrence Berkeley National Lab

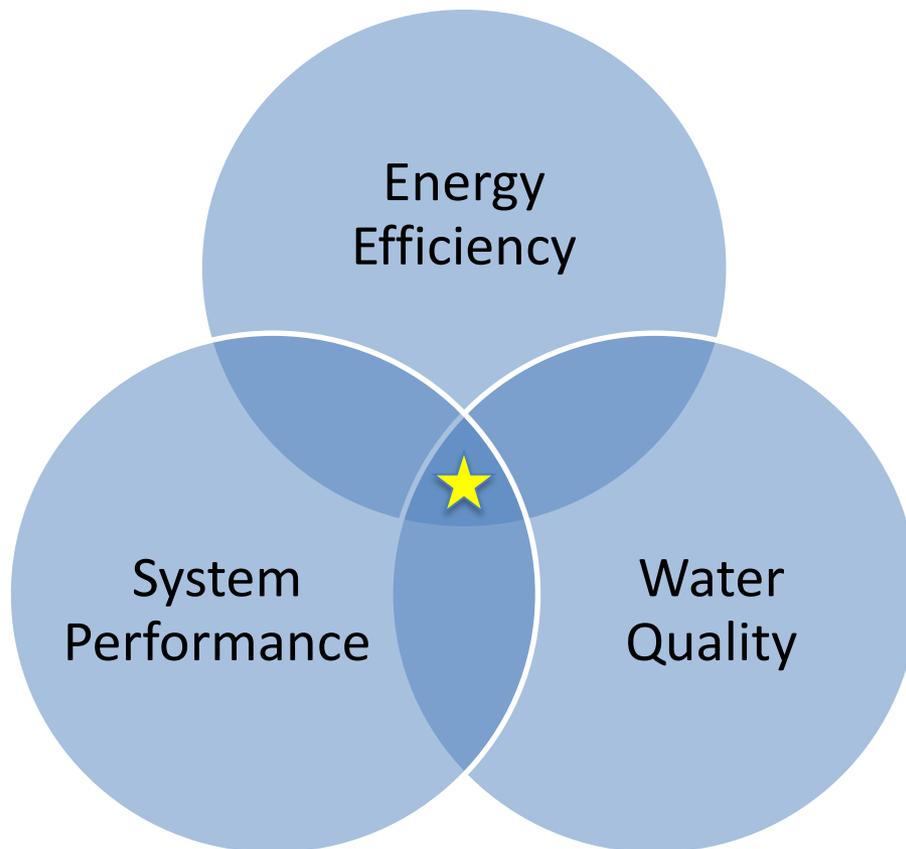


Potential High Impact Projects

- Water system optimization
- Pumping system efficiencies
- Motor management
- Promote water conservation
- Reduce heating and cooling load for buildings and well-houses
- Use of renewable energy



Water System Optimization





Benefits of Water System Optimization

- Reduced water use and costs
- Reduced pressure swings
- Deferred or eliminated capital improvement projects
- Improved chlorine residual
- Reduced disinfection by-product potential
- Longer life of pumps and motors
- Improved system reliability
- Greater operator confidence



Typical Characteristics of an Optimized System

- Keep sources constant
- Use storage efficiently
- Eliminate re-pumping
- Design properly
- Use least expensive water first
- Improve pressure management
- Use the cheapest rate schedule
- Eliminate water loss
- Understand water quality



Motor Management

- Install high efficiency pump motors
- Automate to monitor and control
- Variable frequency drive applications
- Correctly size motors
- Property maintain motors
- Improve power factor



Manage Motor Inventory

- Plan Ahead! When a pump motor goes out is not the time to decide which one you need.
- Resources:
 - U.S. Department of Energy's MotorMaster+
 - <http://www.energy.gov/eere/amo/downloads/motormaster-tool>
 - Software tool to help you compare and understand motor decisions
 - Motor Decisions Matter:
 - <http://www.motorsmatter.org>
 - Motor Planning Kit
 - Simple Savings Spreadsheet



Renewable Energy

- Solar
- Micro-Hydro
- Wind
- Biogas (Wastewater)





Other Options

- Reduce heating and cooling load for buildings and well-houses
 - Insulate
 - High efficiency equipment
- Lighting
- Behavioral / operational changes